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Rivera

(10) **Patent No.: US 6,293,018 B1**
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(54) **MULTIPURPOSE TOOL INCLUDING HANDLES HAVING SEPARATE SIDES**

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(73) Assignee: **Leatherman Tool Group, Inc.**, Portland, OR (US)

(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/065,757**

(22) Filed: **Apr. 24, 1998**

Related U.S. Application Data

(63) Continuation of application No. PCT/US96/19308, filed on Nov. 27, 1996, which is a continuation-in-part of application No. 08/563,922, filed on Nov. 29, 1995, now Pat. No. 5,745,997.

(51) **Int. Cl.**[7] **B26B 1/00**; B26B 7/22

(52) **U.S. Cl.** **30/155**; 7/128; 7/168; 81/427.5

(58) **Field of Search** 30/255, 261, 155, 30/159–161; 81/427.5, 440, 177.4, 177.6, 490; 7/167–168, 158, 127–135, 118

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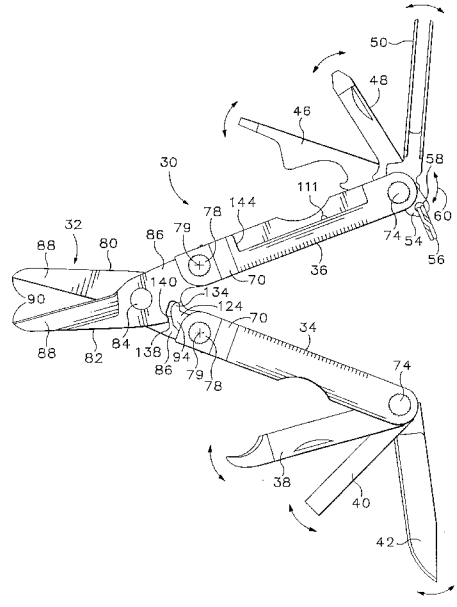
(57) **ABSTRACT**

A multipurpose folding tool (**30**, **280**) including a pair of folding scissors (**32**), in which scissors blades (**80**, **82**) are movable about pivot shafts (**78**), between a stowed position and a deployed position in the handles (**34**, **36**). A rocker (**94**, **96**) is moved by a spring (**106**) in the tool handle and in turn urges a scissors blade toward an open position. In one embodiment four springs (**104**, **106**) hold the handles together with the folded scissors stowed within the handles. When the scissors and other tools are folded into their stowed positions in the handle of the multipurpose tool of the invention the tool has a smooth outside configuration allowing the tool to be carried in a pocket without causing undue wear. A handle (**34** or **36**) may be constructed as a sheet metal channel or a handle (**282**, **284**, **382**, **384**) in two pieces at least one of which includes a perpendicular flange taking the place of a channel bottom portion so that each blade or tool bit may be accompanied by a separate spring (**318**, **418**, **420**).

8 Claims, 13 Drawing Sheets



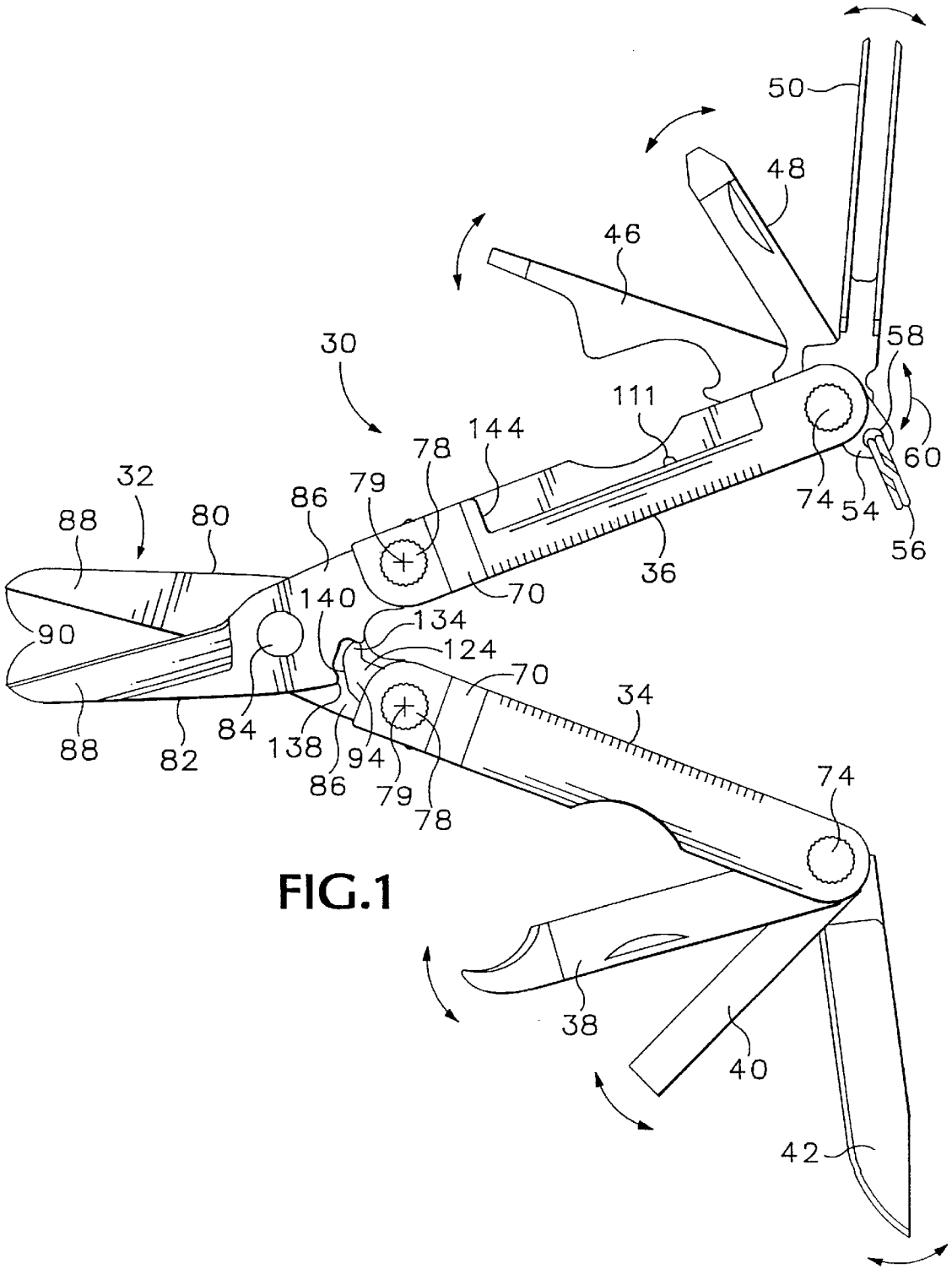

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FIG.1

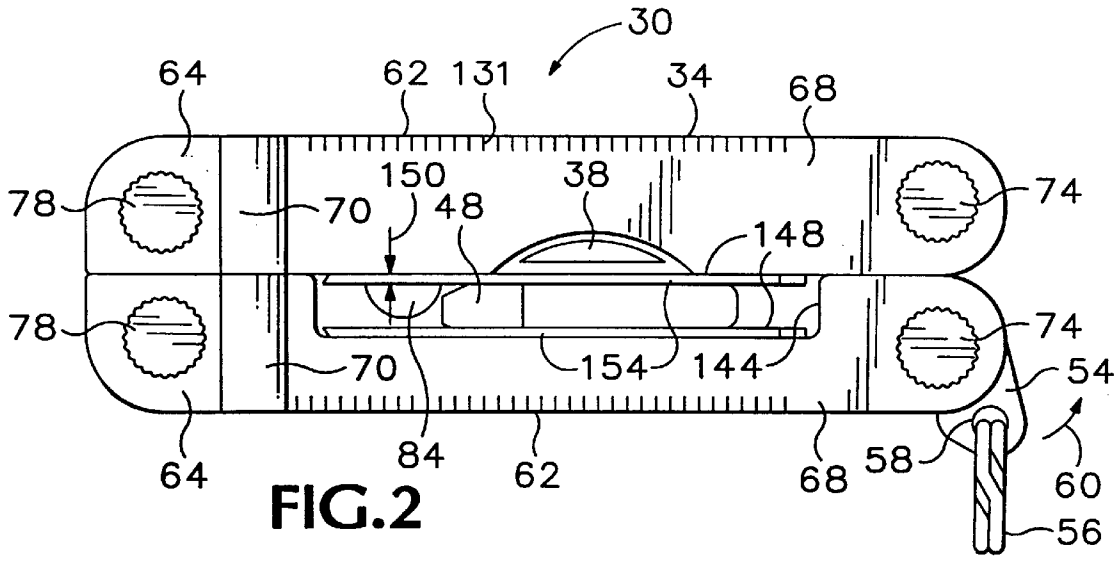


FIG.2

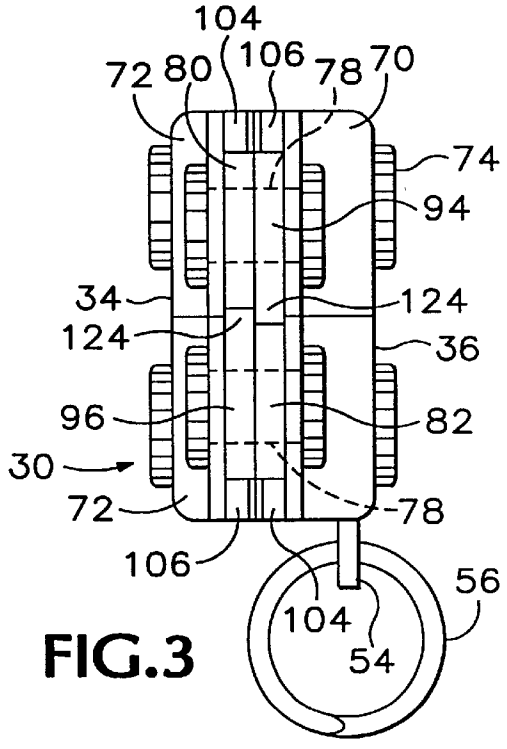


FIG.3

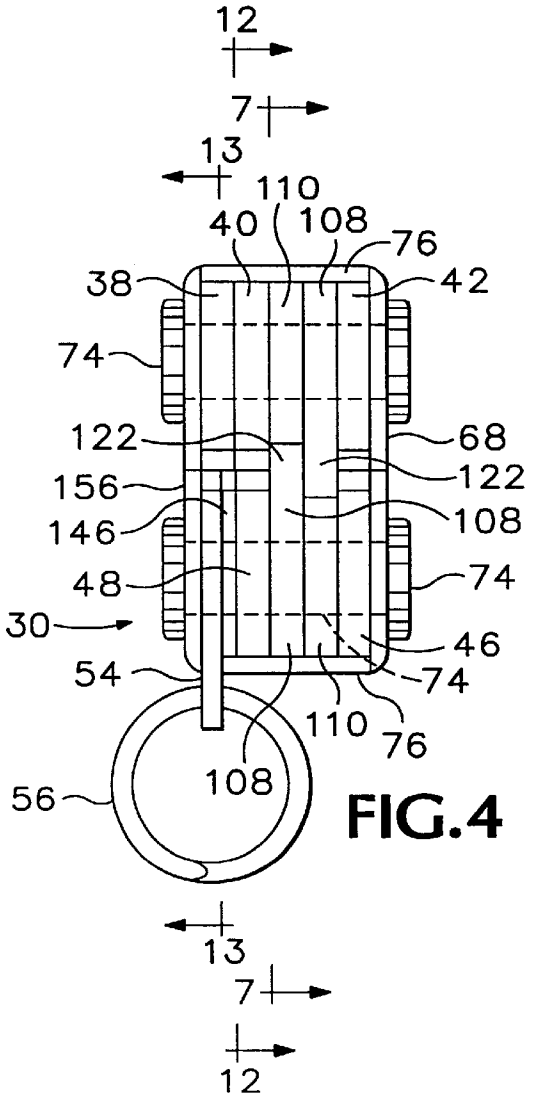
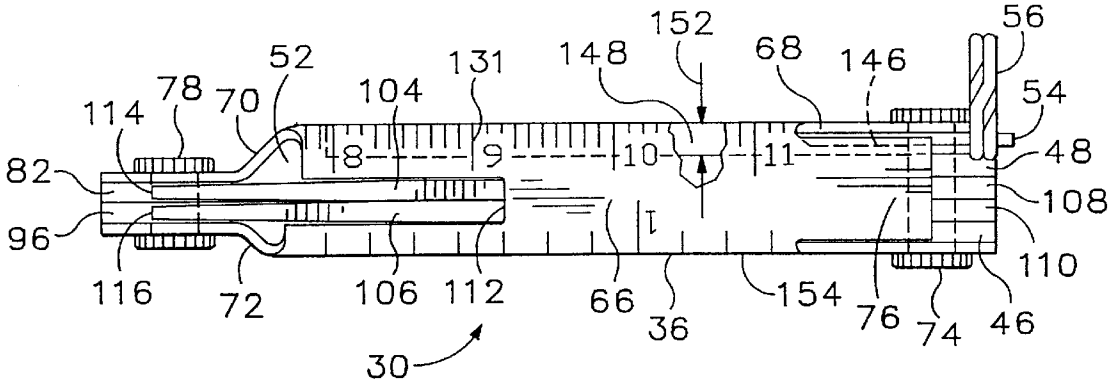


FIG.4



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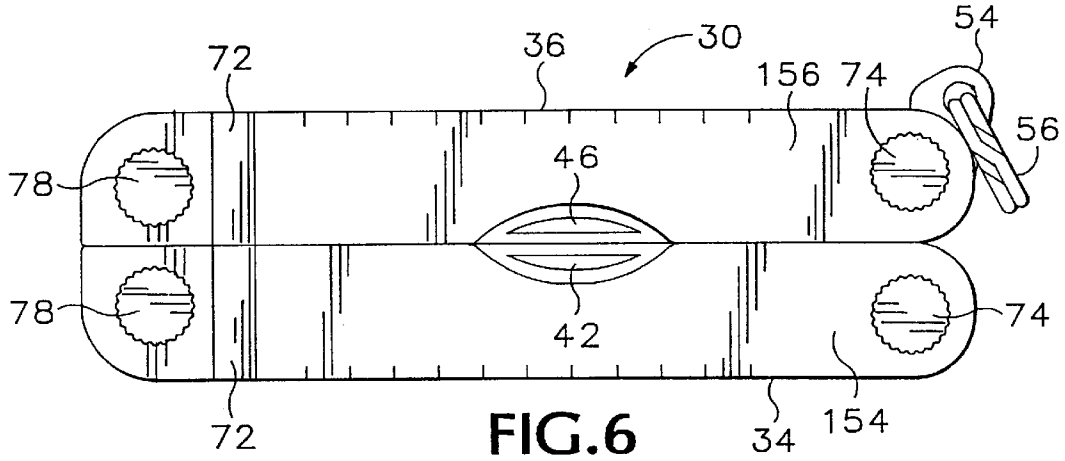

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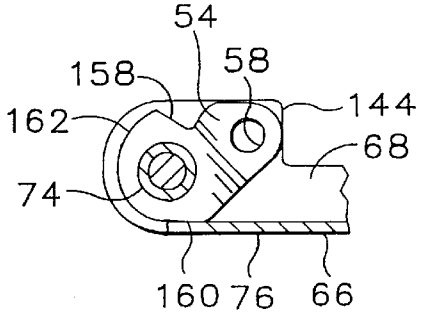

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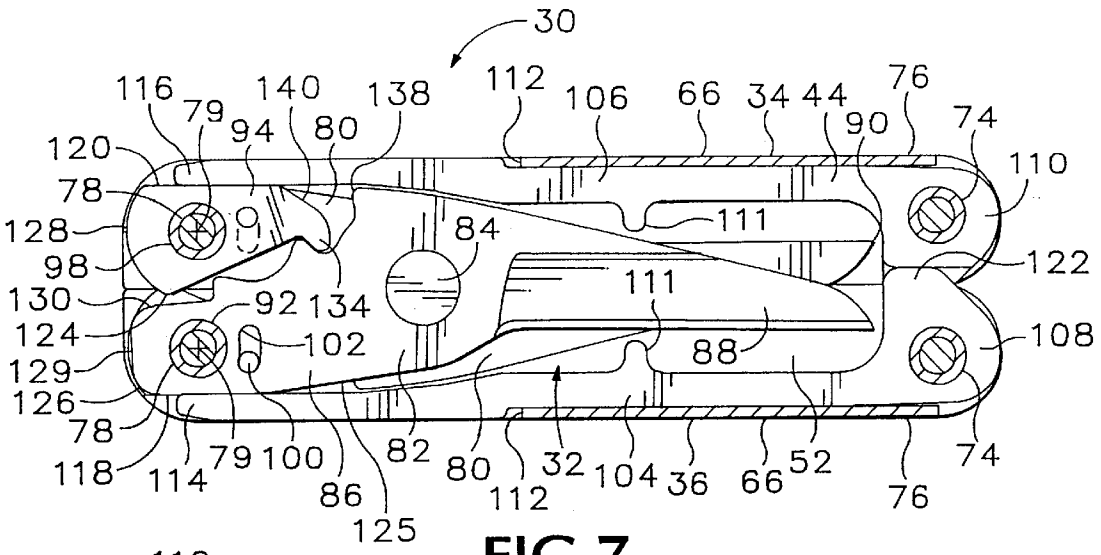
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FIG.7

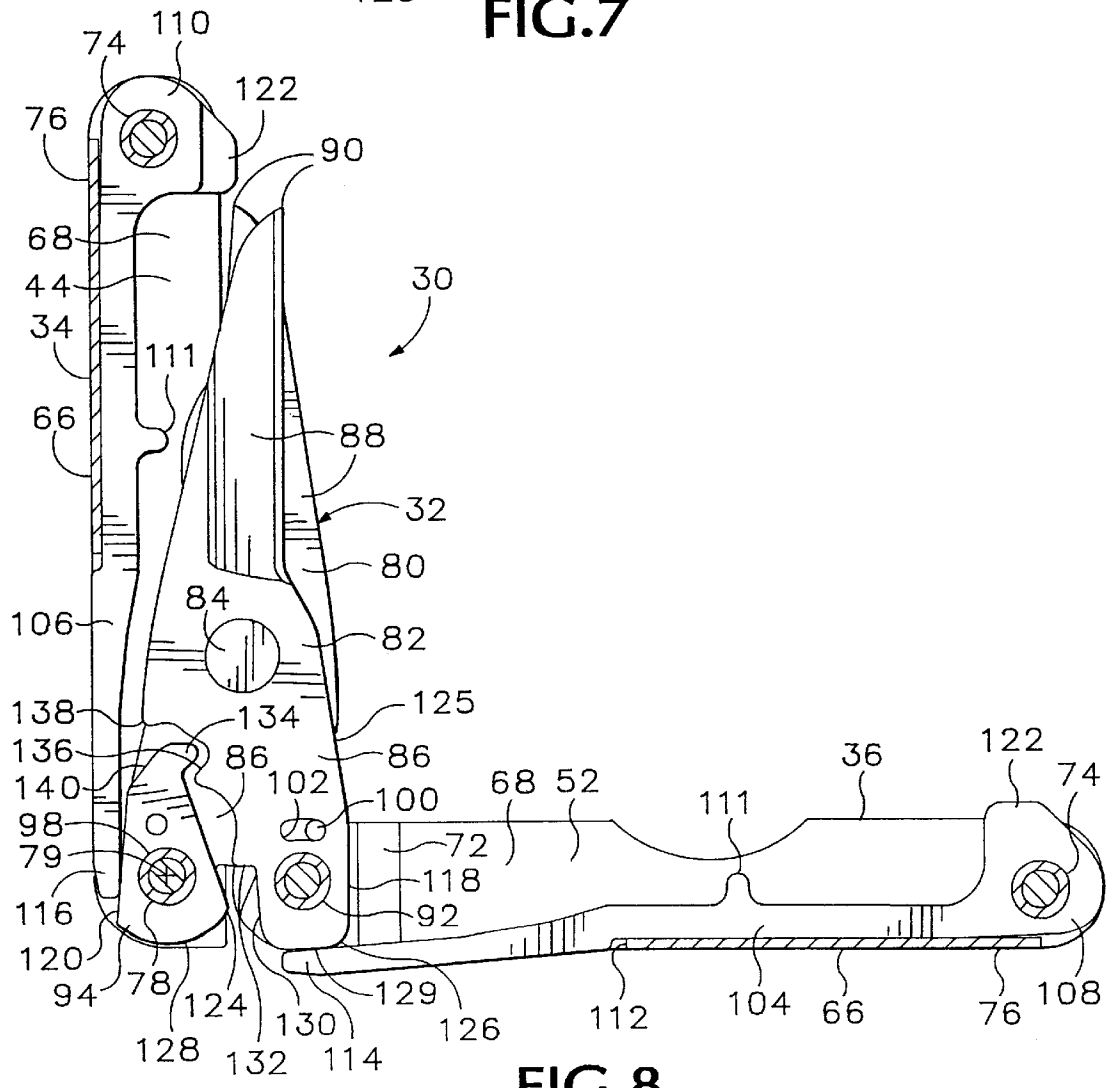
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FIG.8

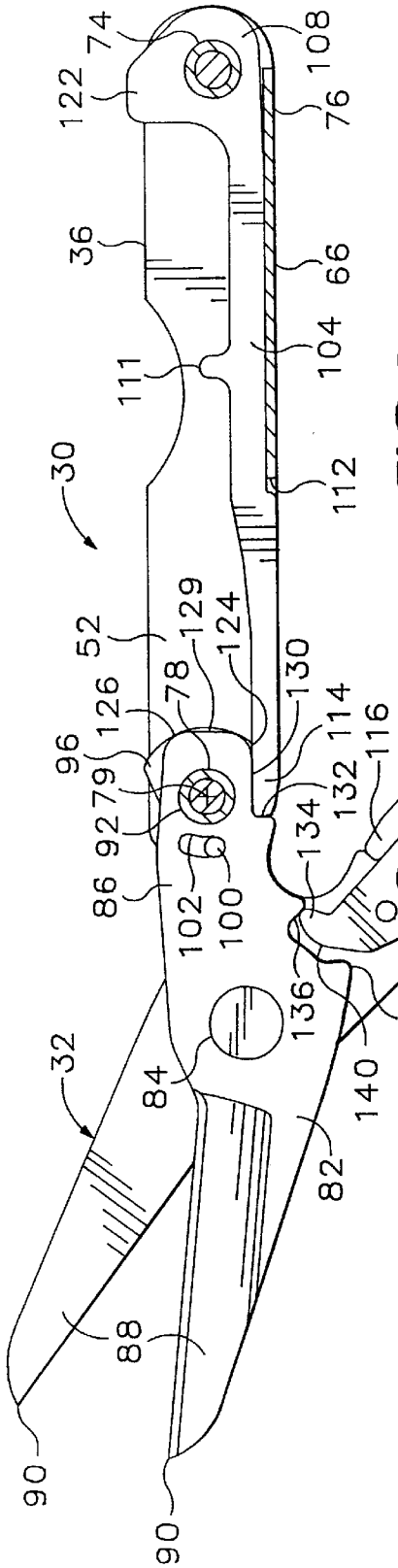
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FIG.9

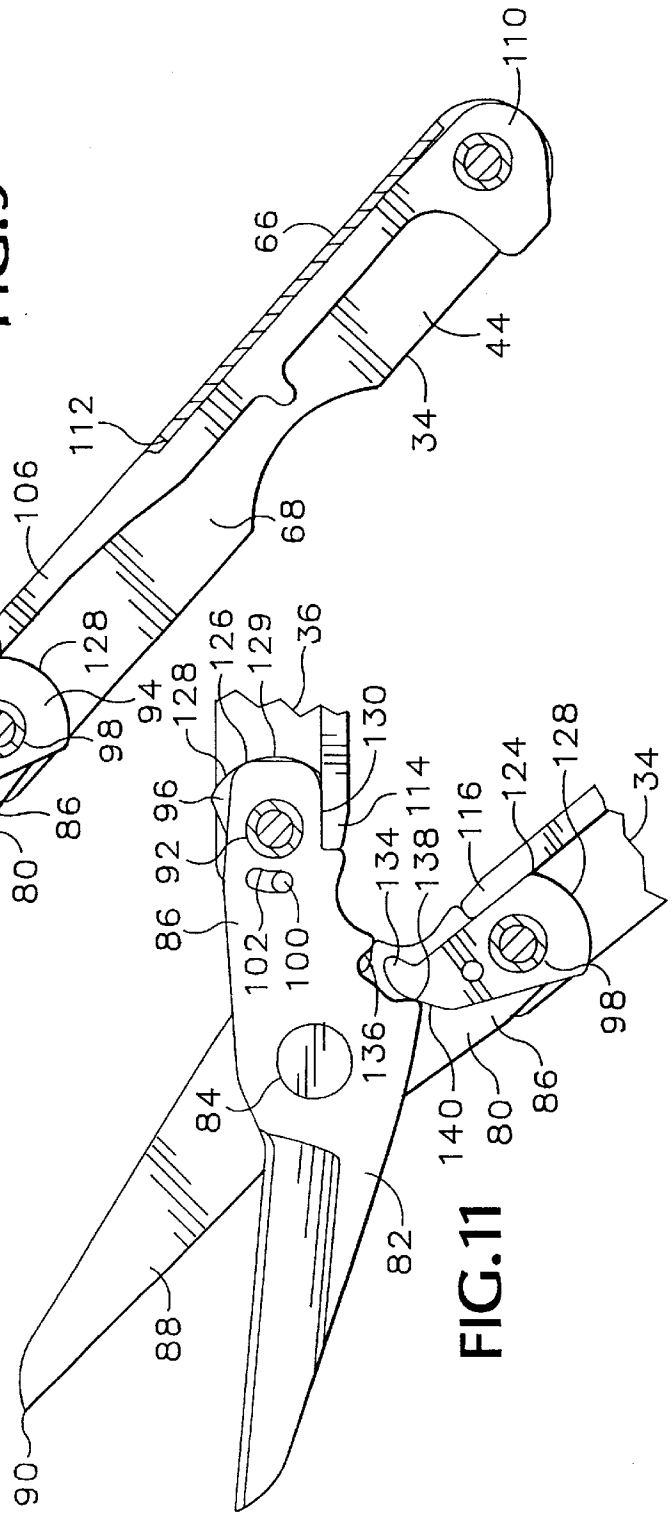
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FIG.11

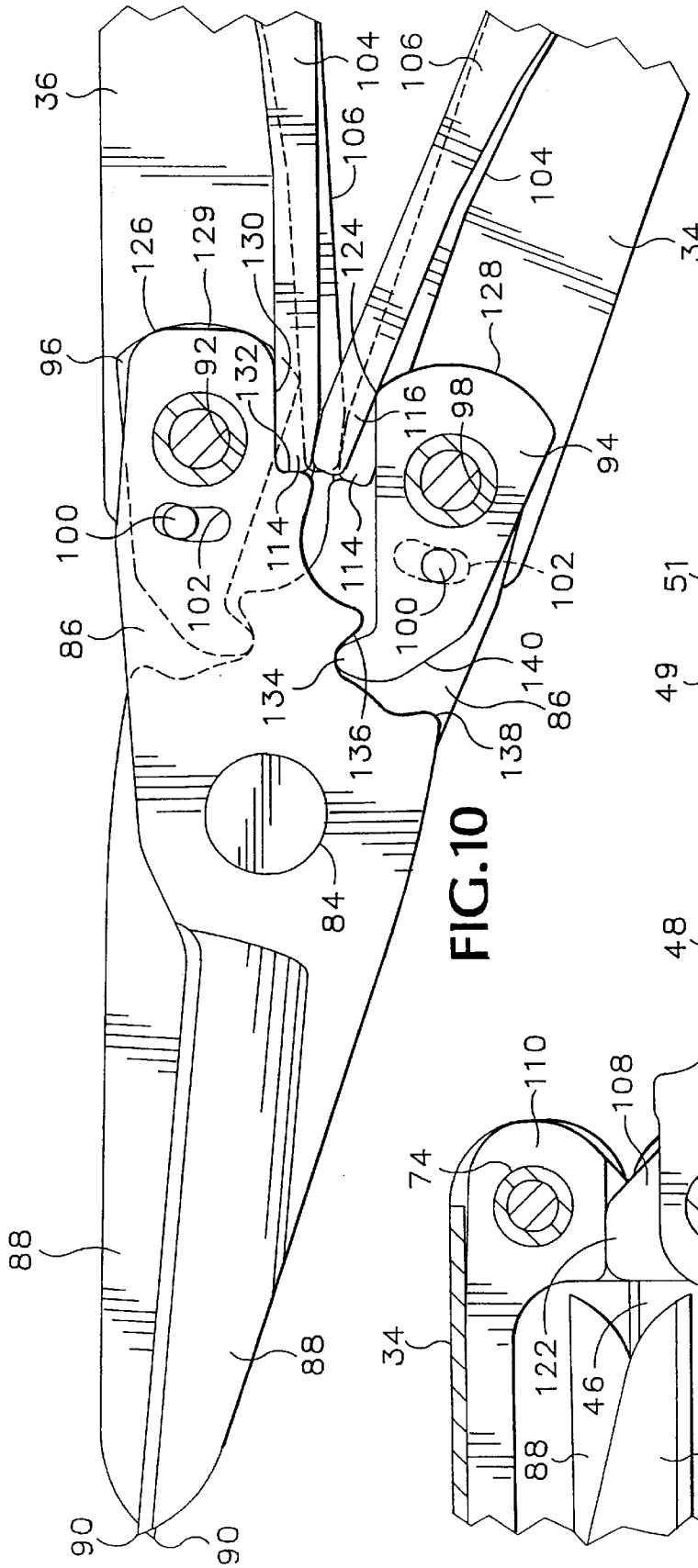
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FIG.10

FIG.12

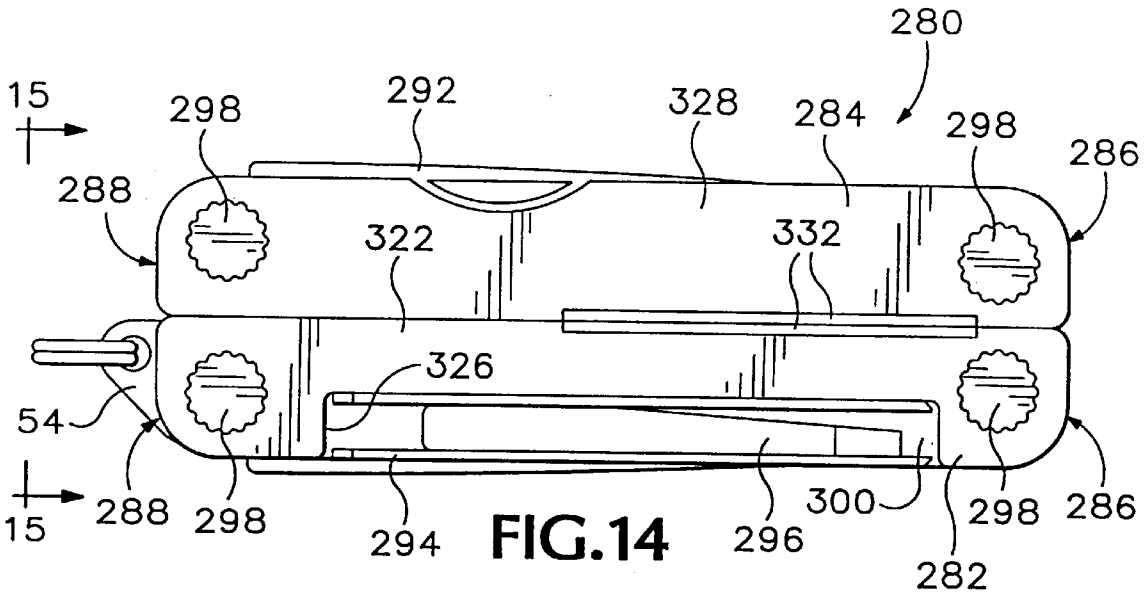
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FIG.14

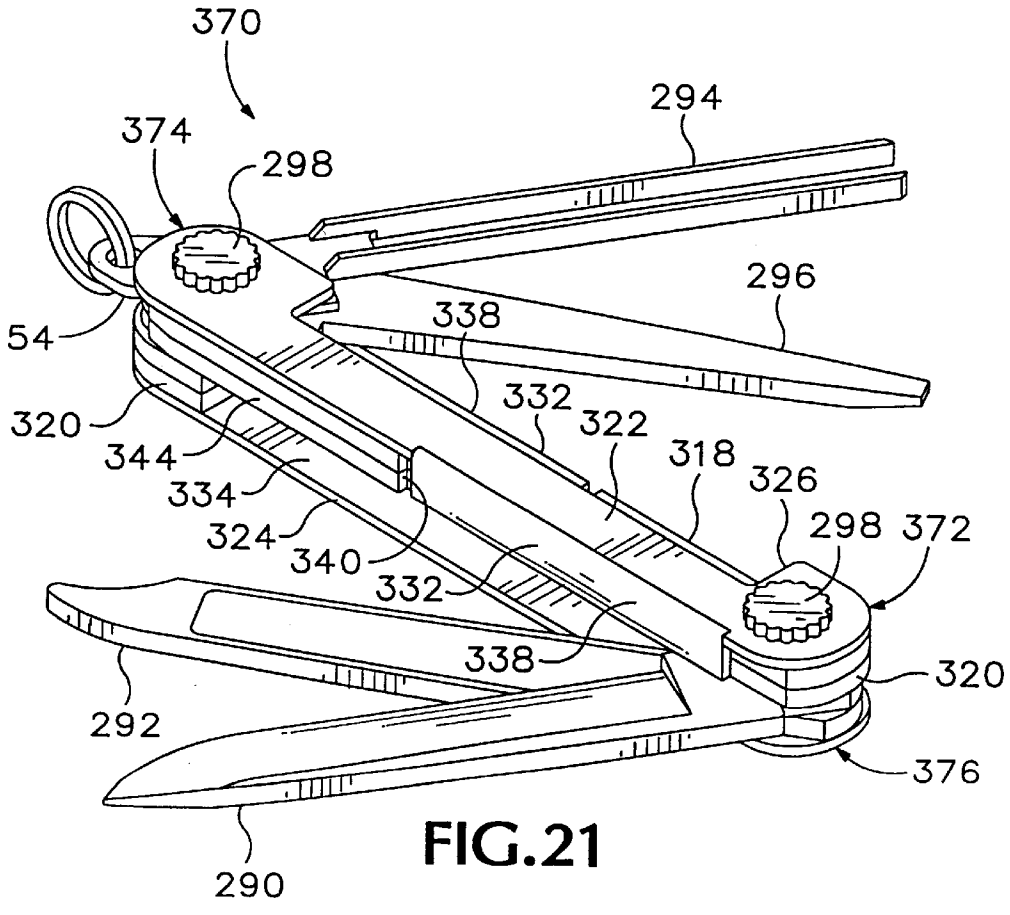
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FIG.21

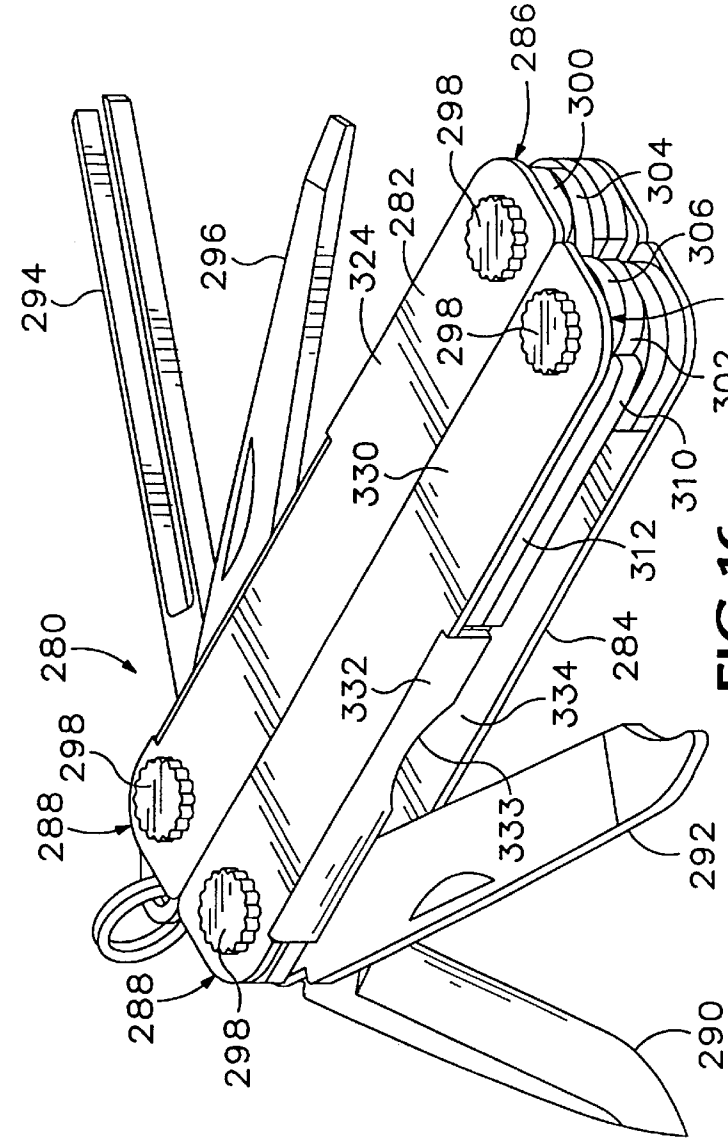
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FIG.16

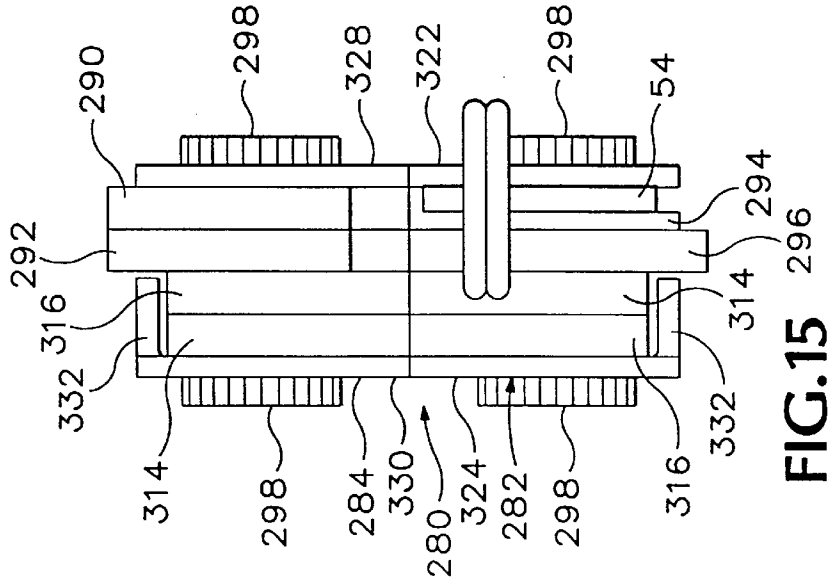
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FIG.15

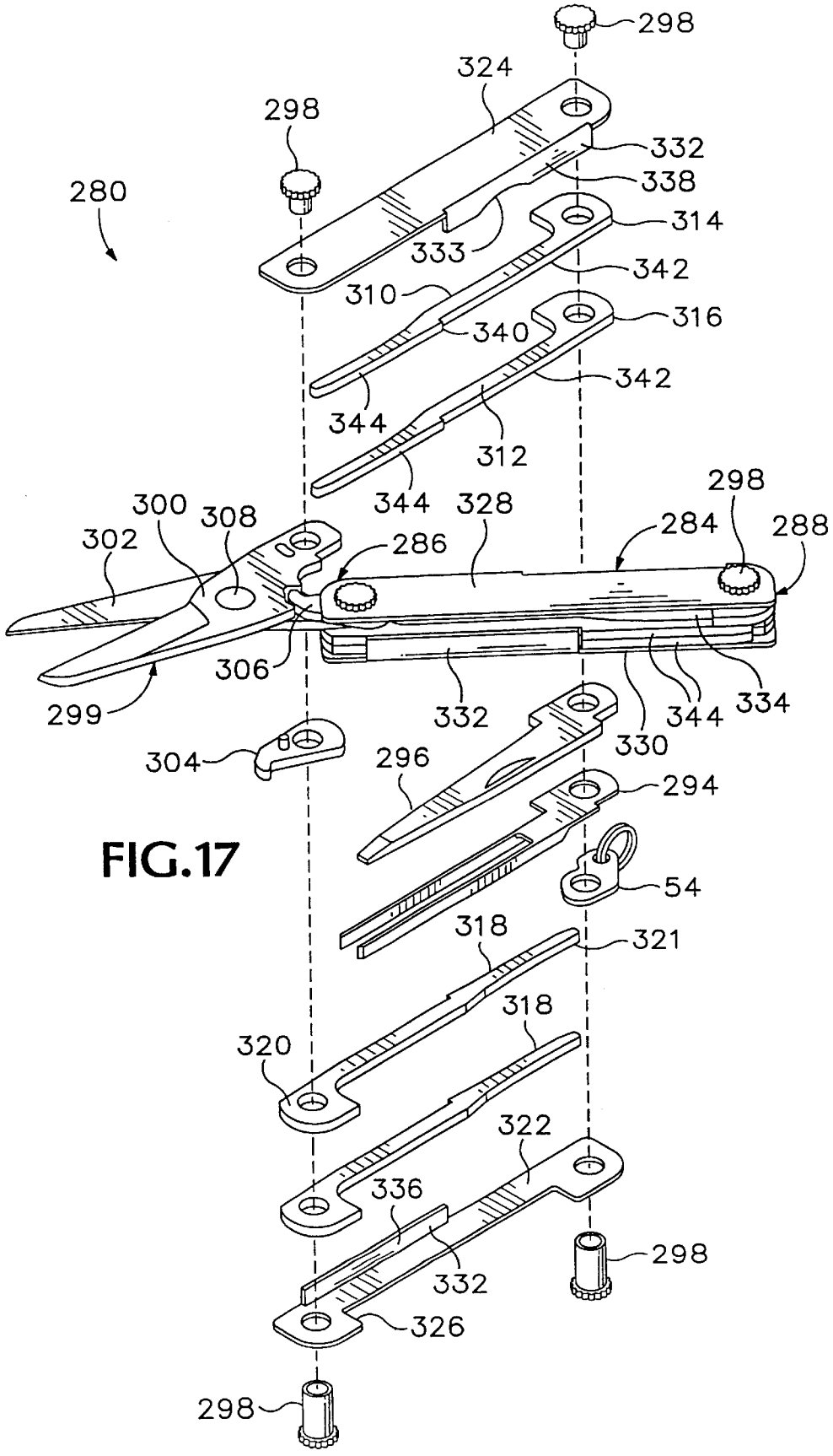
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FIG.17

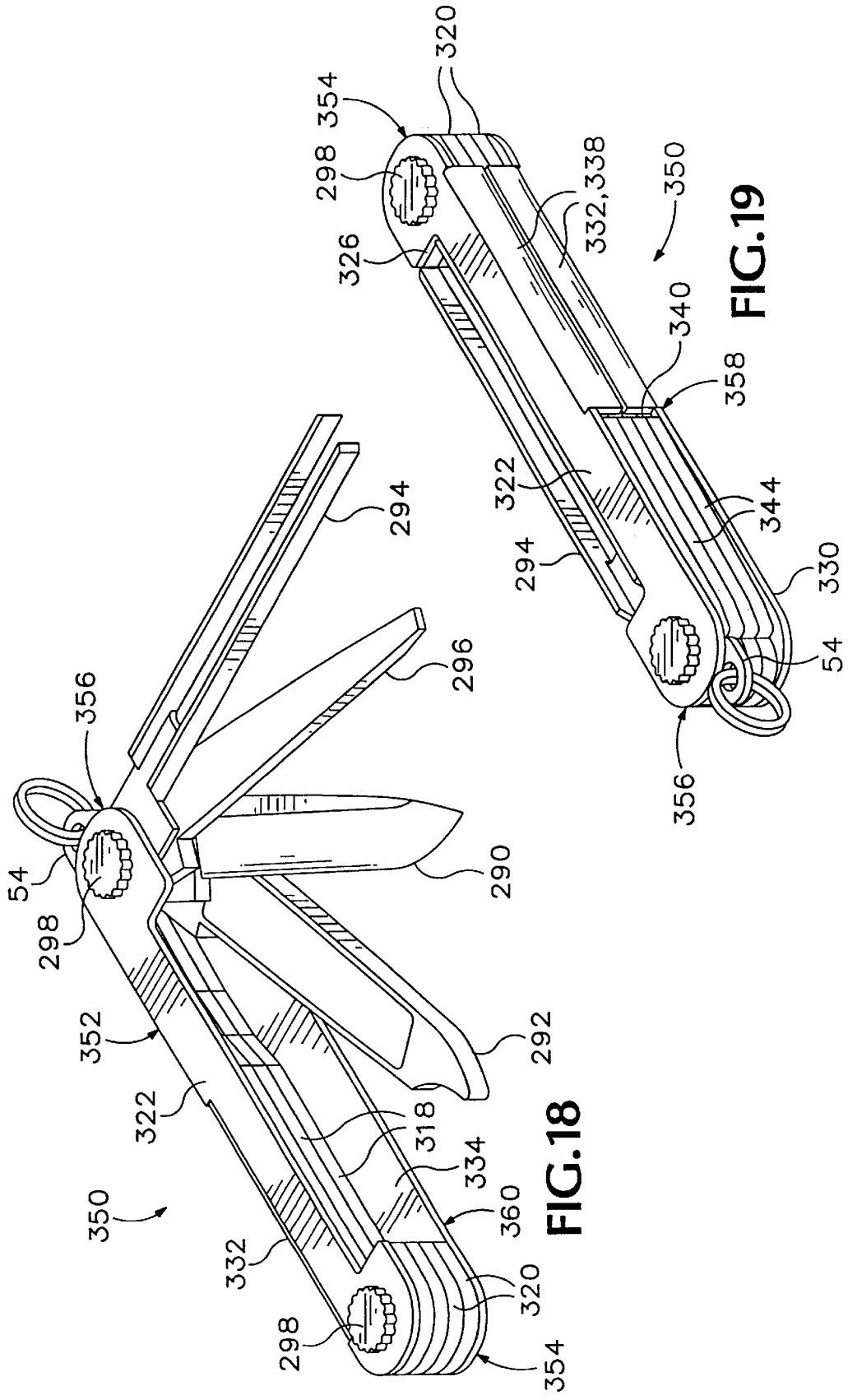
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FIG.19

FIG.18

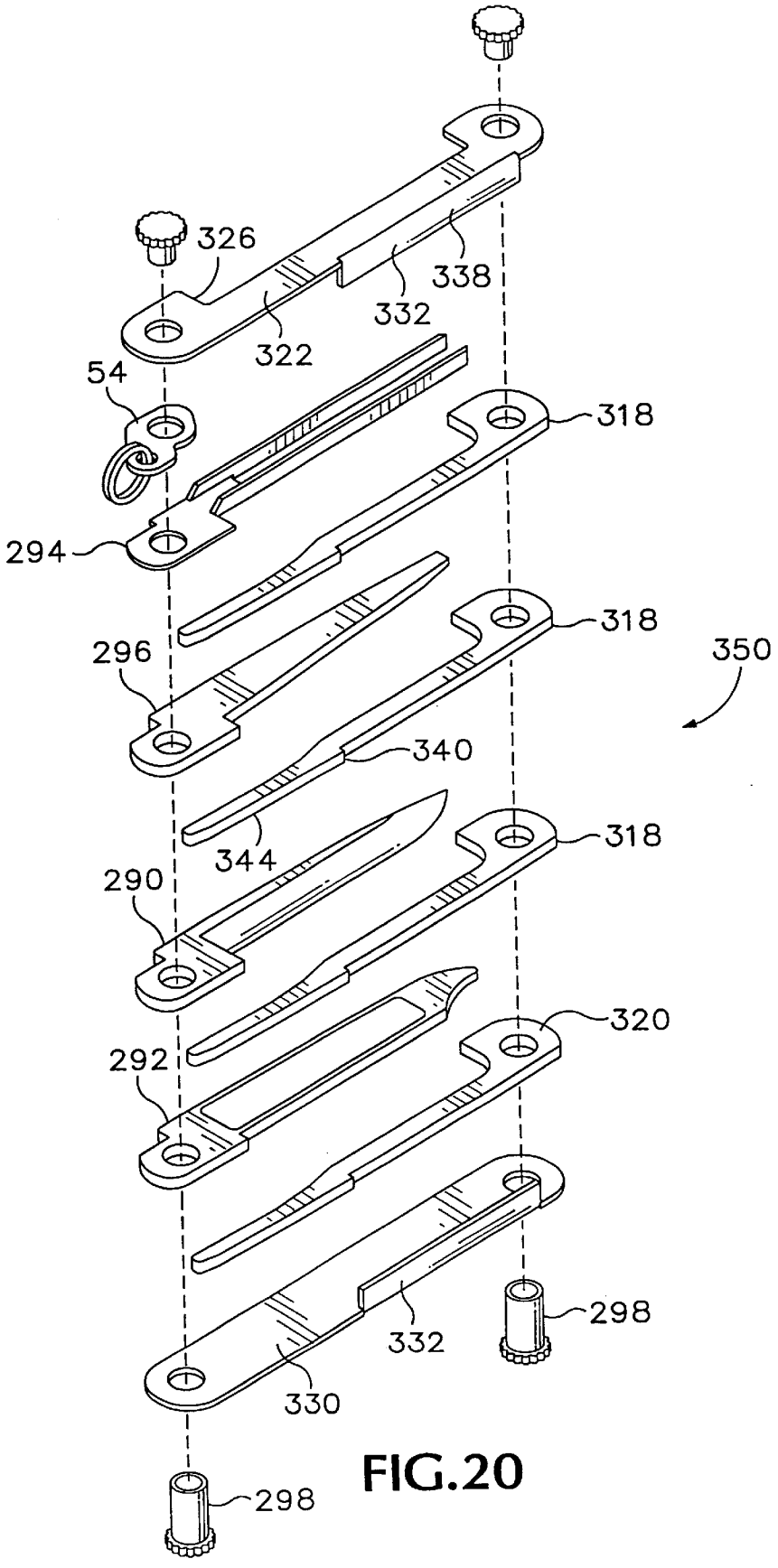
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FIG.20

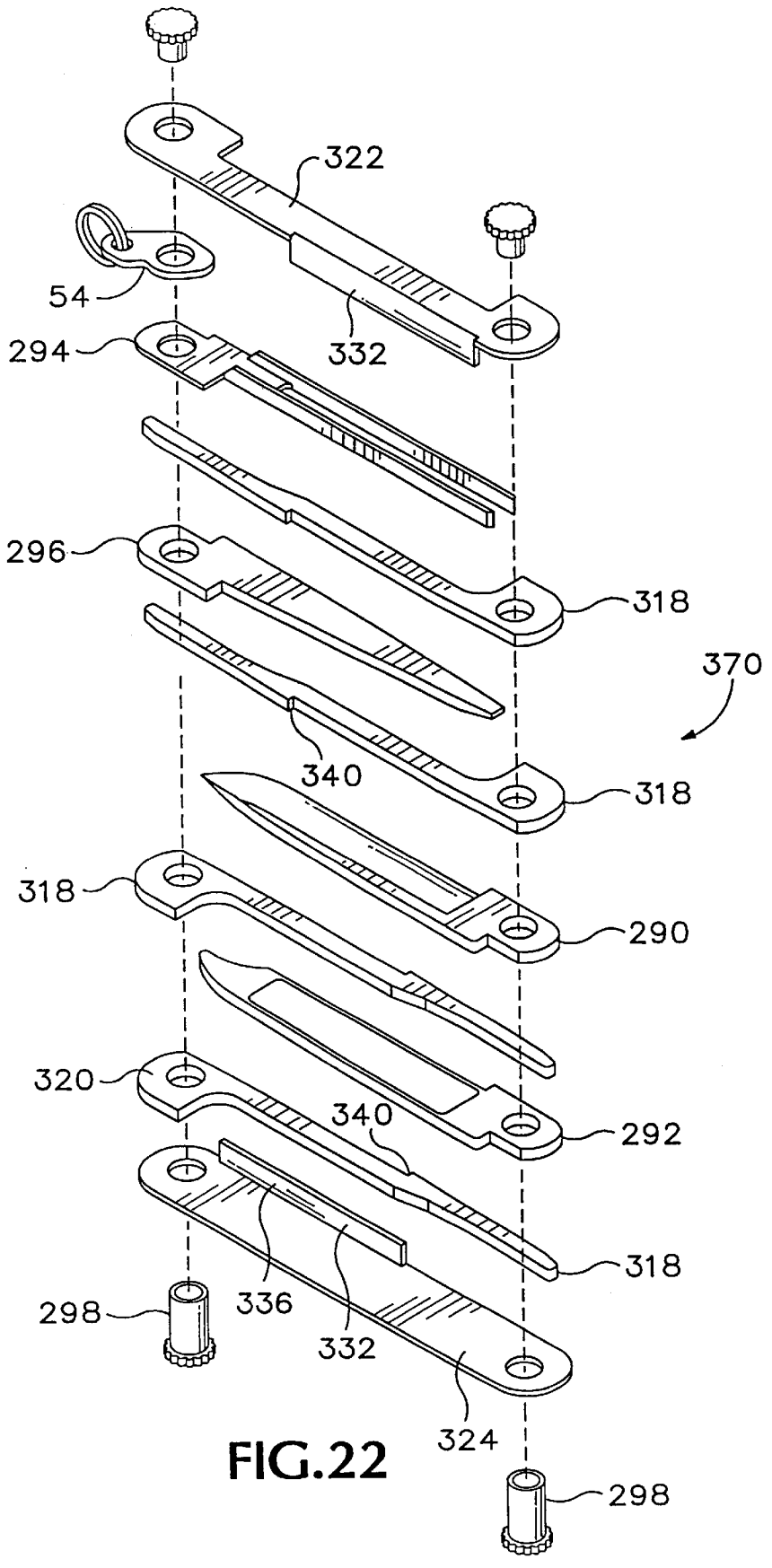
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FIG.22

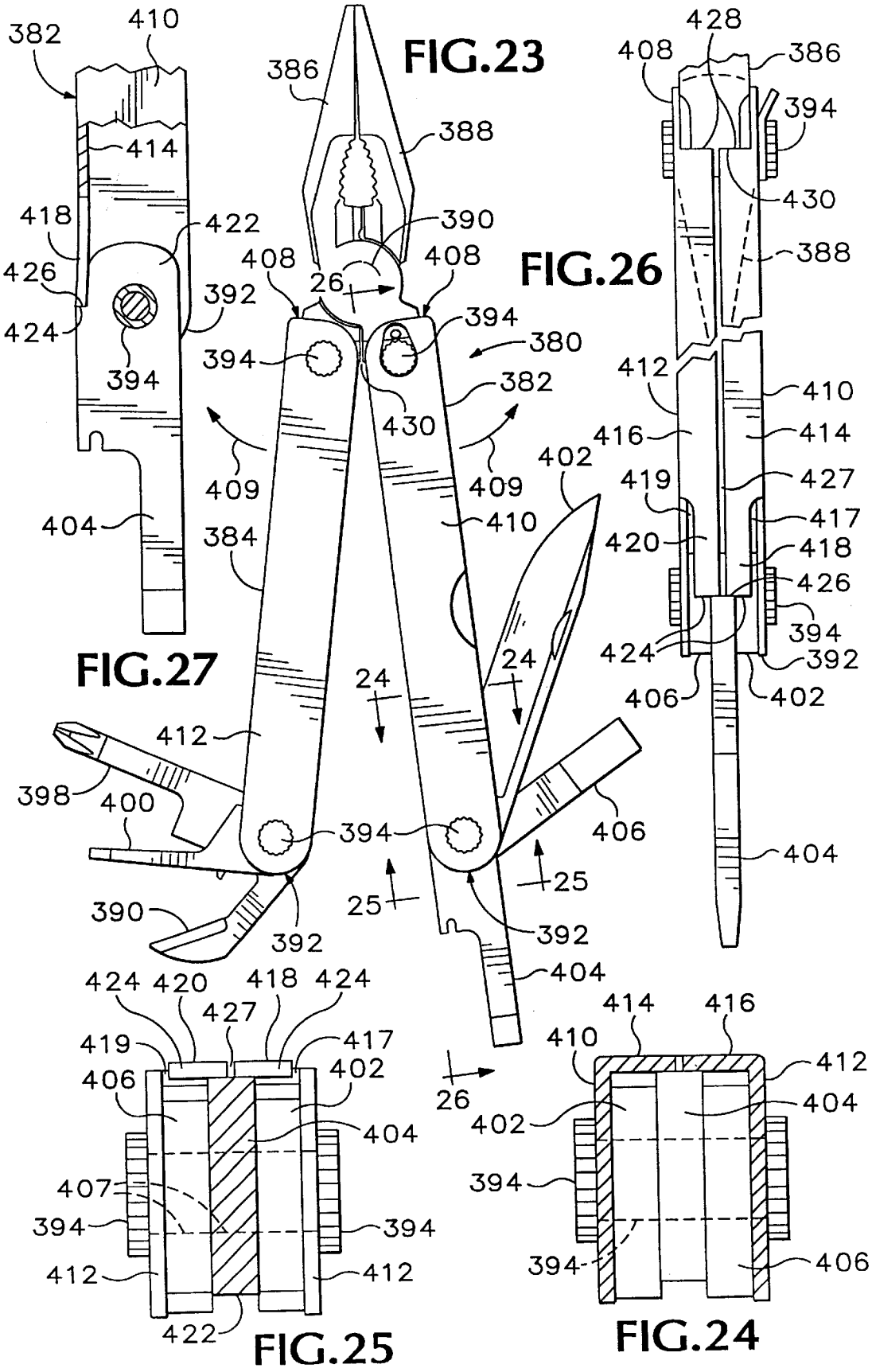
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FIG.27
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FIG.26
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FIG.24

MULTIPURPOSE TOOL INCLUDING HANDLES HAVING SEPARATE SIDES

This application is a continuation of International patent application Serial No. PCT/US96/19308, filed Nov. 27, 1996, which is a continuation-in-part of U.S. patent application Ser. No. 08/563,922, filed Nov. 29, 1995 now U.S. Pat. No. 5,745,997.

TECHNICAL FIELD

The present invention relates to multipurpose folding tools, and in particular to a handle structure and pivotally interconnected blades or jaws for such tools.

BACKGROUND ART

Folding scissors of various types have been known for many years and have long been included in multipurpose folding tools. In the past, most folding scissors in such multipurpose tools have been very small, and therefore relatively ineffective.

One type of folding scissors in a multipurpose tool is disclosed, for example, in Moser U.S. Pat. No. 696,995. In that type of tool one blade of a pair of scissors has an extended handle which is attached to pivot the entire pair of scissors into a storage slot in a knife handle. A second handle and its attached scissors blade are also stowed in the same slot, with the scissors blades and handles generally parallel with one another. A small leaf spring is typically used to urge the handles apart from each other to open the blades of such a pair of miniature scissors, and the spring is kept compressed when the scissors are in the stowed position. The spring typically used in such scissors is easily lost or accidentally bent to an inoperative condition.

East German Patent Publication 2,322,229 discloses another type of folding scissors using a long spring in a handle of a tool to move an auxiliary lever to urge a handle of a movable scissors blade in a blade-opening direction. This arrangement, however, fails to hold the handle of the main scissors blade stably fixed relative to the tool handle when the movable scissors handle and blade are urged in a blade-closing direction with respect to the main blade.

German Patent No. 145784 discloses a tool incorporating a folding handle with a pair of scissors blades which can be stowed within a multipurpose tool handle, but such scissors include the previously mentioned type of spring or none at all.

In previously-known folding scissors including a spring for opening the scissors blades, the force needed to move the blades in a closing or cutting direction has increased with continued closing movement of the blades. It is therefore desired to provide scissors which are easier to use in that the force needed to close the blades completely is not greatly increased over that required to close the blades partially during a cutting stroke of the scissors.

Many types of multipurpose pocket tools and pocket knives are known in which various knife blades, screwdrivers or other tool bits fold into storage locations within either a handle, or pair of handles. In some such multipurpose pocket tools, the handles are configured as channels of formed sheet metal that are able to pivot around the bases of a central pair of tool blades or jaws to reduce the size of the channel shaped handles as the outer surface of the folded tool.

In the case of previously known multipurpose folding hand tools, the typical channel-shaped handles do not provide spring pressure separately to each blade in order to hold it in the closed or open position. There is typically one spring, usually integral to the handle, which cannot hold all the blades contained within closed without some looseness. Therefore, the typical way to hold the blades closed is by side friction applied by the blade pivot pin. Blade looseness may allow the tips of the blades to open slightly, exposing the sharp and potentially dangerous edges. Side friction can sometimes be overcome by a jolt to the tool, causing the blades to unfold partially, exposing the sharp and potentially dangerous edges. The ideal side friction required for holding the blades in the channel-shaped handles without individual springs requires manual adjustment and is difficult to achieve. Channel-shaped handles are thus difficult to manufacture and assemble. For these reasons, it has become customary for good tool design to dictate that handles of a pair first be spread apart from each other in order to gain access to the blades contained within the handles. When the tool is folded closed, the opposite tool handles prevent the accidental partial opening of the blades.

In some pocket knives, the handles are configured as generally flat pieces of sheet metal which sandwich the various blades. Each blade pivots about a pin located at its base and is held either open or closed by an individual spring which must be supported at its base and near its center in order to provide adequate spring pressure. This center support is typically provided by a pin.

Each blade of a pocket knife typically has its own individual spring to bias it closed. This allows the blades safely to be located on the outside of the tool, as they cannot accidentally open. If a jolt to the knife partially opens a blade, its spring forces it closed again. The typical generally flat handle pieces are what provide support to keep the three pins where they are required to make the individual springs work. The individual spring and three-pin design, however, represents less efficient use of space than the channel-shaped handle design typically used in multipurpose folding hand tools.

What is needed, then, is an improved multipurpose folding tool including a central folding tool easily used, and which does not interfere with the utility of other folding tool bits included in the multipurpose folding tool. It is also desired for such folding scissors to be larger than previously available folding scissors included in a multipurpose folding tool of a comparable size, and that the entire tool in a folded configuration can be easily carried in a person's pocket without causing unnecessary wear of the fabric of the pocket. It is also desired for individual blades of a multipurpose tool to be held securely so that they can safely be located on the outer side of a handle of such tool in its folded configuration. Finally, it is desired for such a multipurpose tool to be simple to assemble and to be able to be assembled in different arrangements.

DISCLOSURE OF THE INVENTION

The present invention provides a multipurpose folding tool which overcomes the previously-mentioned shortcomings and disadvantages of previously known folding tools by providing improved folding scissors and other tools having pivotally interconnected jaws or the like.

In one embodiment of the present invention a channel-shaped folding handle is attached to each of a pair of interconnected movable members such as the blades of a pair of scissors and a pair of springs in each handle operate, respectively, on the attached member, such as a scissors blade, and on an adjacent rocker. Both of such springs in

each handle operate to hold the handles together with the multipurpose tool in a folded configuration. With the scissors, for example, ready for use, one spring in each handle holds the attached scissors blade securely aligned with the handle, while the other spring operates the associated rocker to urge the scissors blades toward an open position after each cutting stroke. Each rocker is linked with the adjacent scissors blade so that the rocker is free to pivot through a small angle relative to the blade but is moved along with the blade between the stowed position and the deployed position of the blade.

In a preferred embodiment of the invention, additional folding tool bits are included in the handles, mounted on tool pivot shafts spaced apart in the handles from the location of the scissors blades. When such tool bits are used, the handles are prevented from moving laterally with respect to each other in one embodiment of the invention by an ear on one of the springs in each handle and by a portion of each rocker extending alongside the scissors blade associated with the other handle.

In one embodiment of the invention a lanyard-attachment ear mounted on a pivot shaft may be extended for use or folded into a stored position where it is not likely to wear the fabric of a pocket in which the tool is carried.

Another embodiment of the present invention also provides a means of simplifying the manufacture and assembly of multipurpose folding hand tools by eliminating the channel-shaped handle construction while maintaining the efficient use of space provided by the channel-shaped handle design. In this embodiment of the invention, the traditional channel-shaped handle is replaced by two L-shaped handle pieces each having a flange included in a piece which is a side of a handle. Blades may be mounted at either end of the handle on pins which join the sides of the handle to each other. Each blade has its own spring which is attached to the handle by a pin or shaft through its base portion at the opposite end of the handle. Each spring is supported near its center by the flange that forms the leg of the L-shaped handle piece.

In multipurpose folding hand tools, this aspect of the invention allows the incorporation of an individual spring for each of the blades or other tool bits contained within the handles. These springs bias the individual blades closed and allow them to be accessible from the outside of the tool when the handles are folded closed without sacrificing safety. This eliminates the time-consuming task of opening the tool handles in order to open or fold away a blade. Manufacture is simplified by use of L-shaped handle pieces because handle side parallelism and hole alignment are facilitated, polishing is simplified because of improved access to the inside, and heat treatment warpage is reduced because of reduced internal stresses and increased robustness of the part. Assembly is simplified by eliminating the channel structure because the components can be stacked up one piece at a time, including the handle pieces, and fastened together rather than the internal components having to be stacked up and inserted into the channel structure.

According to this aspect of the invention two L-shaped handle pieces, the second one generally being the mirror image of, and optionally rotated 180° from the first, replace the usual flat side pieces. There are two holes in each handle piece which, when arranged as described, generally line up with each other in order to accept pins which will attach the two pieces together.

In various embodiments of this aspect of the invention, blades or other tool bits may be attached at only one end, or at each end, of the handle. The blades may all fold out of one side of the handle, or from both sides. Each blade has its own spring, supported near its center by the flange, the leg of the L-shaped handle piece. This leg of the "L" efficiently replaces the traditional third pin. The spring for each blade also serves as a spacer for that blade at the opposite end of the handle. The number of blades a handle may contain is thus limited only by the width of the flange and the thickness of the blades and springs.

Laterally adjacent blades or tool bits in a handle are engaged by tapered tips of adjacent springs each engaging only a particular one of the adjacent blades.

In other embodiments of the invention, pliers or other tools may include jaws or jawlike members pivotally interconnected with each other and arranged to be folded and stowed in tool handles in a manner similar to that in which the scissors blades operate and are interrelated with the tool handles.

In one such embodiment of the invention at least one and preferably each of a pair of opposite handle sides includes a flange extending over most of its length, and a leaf spring extends from the flange longitudinally of the handle to bear on a surface of the base of a foldable tool blade. A pair of such handles may each have a base of one of a pair of pliers jaws between the handle sides at one end of each handle, while knife blades or other tool bits are located at the end of the handle where the leaf spring is located.

The foregoing and other objectives, features, and advantages of the invention will be more readily understood upon consideration of the following detailed description of the invention, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an elevational view of a multipurpose folding tool which is an embodiment of the present invention.

FIG. **2** is a left side view of the tool shown in FIG. **1**, in a folded configuration.

FIG. **3** is a scissors end view of the tool shown in FIG. **1**, in the folded configuration shown in FIG. **2**.

FIG. **4** is a tool bit end view of the tool shown in FIG. **1**, in the folded configuration shown in FIG. **2**.

FIG. **5** is a bottom view of the tool shown in FIG. **1**, in the folded configuration shown in FIG. **2**.

FIG. **6** is a right side view of the multipurpose tool shown in FIG. **1**, in the folded configuration shown in FIG. **2**.

FIG. **7** is a sectional view of the multipurpose tool shown in FIG. **1**, taken along line **7**—**7** of FIG. **4**.

FIG. **8** is a sectional view similar to that of FIG. **7**, showing the multipurpose tool with one handle in a partially extended position.

FIG. **9** is a sectional view of the same portion of the tool as shown in FIG. **7**, showing both handles extended with the scissors blades of the multipurpose tool in their deployed, open positions, ready for use.

FIG. **10** is a sectional view, similar to that of FIG. **9**, of a detail of the scissors and a portion of each of the handles of the tool with the scissors blades in their fully closed position.

FIG. **11** is a sectional detail view of the same portion of the tool shown in FIG. **9**, showing the scissors blades opened to their maximum separation.

FIG. **12** is a sectional view of a portion of the tool bit end of the multipurpose tool, taken in the direction of line **12**—**12** in FIG. **4**, showing the flat Phillips screwdriver blade in its deployed position.

FIG. **13** is a sectional view of a portion of one of the handles of the tool, taken in the direction of line **13**—**13** of FIG. **4**, showing the lanyard attachment eye in a pocket-carried configuration of the tool.

FIG. **14** is a side elevational view of a multipurpose folding tool which is another embodiment of the present invention.

FIG. **15** is an end view of the tool shown in FIG. **14**, taken along line **15**—**15**.

FIG. **16** is a perspective view of the multipurpose tool shown in FIG. **14**, with several tool blades partially unfolded.

FIG. **17** is a perspective view of the tool shown in FIGS. **14**, **15** and **16**, with an included pair of scissors deployed, and with one handle and the associated tool blades shown in exploded view.

FIG. **18** is a perspective view of a multipurpose folding tool which is yet another embodiment of the present invention, showing its several tool blades partially unfolded.

FIG. **19** is a perspective view of the back side of the multipurpose folding tool shown in FIG. **18**, with all of the several tool blades folded.

FIG. **20** is an exploded perspective view of the tool shown in FIG. **19**.

FIG. **21** is a perspective view of a multipurpose folding tool which is yet a further embodiment of the present invention, showing all of its several tool blades partially opened.

FIG. **22** is an exploded view of the tool shown in FIG. **21**, with all of the several tool blades folded.

FIG. **23** is a front elevational view of a multipurpose tool which is yet a further embodiment of the present invention, with its several blades partially opened and its pliers deployed.

FIG. **24** is a section view of one handle of the multipurpose tool shown in FIG. **23**, taken along line **24**—**24**.

FIG. **25** is a view taken along line **25**—**25**, of the multipurpose tool shown in FIG. **23**.

FIG. **26** is a view of one of the handles of the multipurpose tool shown in FIG. **23**, taken in the direction indicated by the line **26**—**26**.

FIG. **27** is a partially cutaway fragmentary view of the handle shown in FIG. **26**.

BEST MODES FOR CARRYING OUT THE INVENTION

Referring now to FIGS. **1**–**13** of the drawings which form a part of the disclosure herein, a folding multipurpose tool **30** includes a pair of folding scissors **32** which can be received within a pair of handles **34** and **36** when the tool **30** is in a folded configuration as shown in FIGS. **2**–**7**. Additional tool bits, such as a nail file **38**, a medium screwdriver **40**, and a knife blade **42**, may be stowed within a cavity **44** defined within the first handle **34**, and a combined small screwdriver and cap lifter **46**, a flat Phillips screwdriver **48**, and a pair of tweezers **50** may be stowed within a cavity **52** defined within the second handle **36**. The just-mentioned additional tool bits may each be extended to a position parallel with the respective handle **34** or **36** for use. A lanyard attachment ear **54** is attached to the second handle **36**, and a split ring **56** or other suitable fastening device may be engaged in a hole **58** defined in the lanyard receiving ear **54**. The lanyard receiving ear **54** is movable in the direction indicated by the arrow **60**, as will be discussed in greater detail subsequently.

Each of the handles **34** and **36** includes a wide portion **62** and a narrow scissors-end portion **64**, formed appropriately of stainless steel sheet generally in the form of a channel including a bottom portion **66** (see FIG. **5**). Respective side walls **68** extend generally perpendicularly away from the bottom **66** and parallel with each other except in tapering portions **70** and **72**.

A tool pivot shaft **74**, which may be a tubular internally threaded screw fastener with a mating externally threaded counterpart, is located in the wide portion **62** of each of the handles **34** and **36**, extending transversely between the side walls **68** at a tool bit end of each handle. During assembly of the tool **30** the tool pivot shafts **74** are adjusted to provide sufficient tension to ensure a snug fit between the sidewalls **68** for the members rotating thereon, yet permit smooth movement, and are then held in the required position by an adhesive. The tool pivot shafts **74** act as fulcrums for each of the tool bits such as the knife blade **42** and tweezers **50**. A leaf spring **76** is a cantilevered extension of the bottom **66** and bears upon the base portion of each of the folding tool bits to hold them selectively in an extended position, parallel with the respective handle **34** or **36** and ready for use.

At the scissors-end portion **64** of each handle, a respective scissors pivot pin **78**, which may also be called a jaw pivot pin, is a fastener similar to the tool pivot shaft **74**, but shorter.

The folding scissors **32** included in the folding tool **30** include a pair of blades, a first scissors blade **80** and a second scissors blade **82**, which pivot with respect to each other about a scissors pivot joint **84** defined, for example, by a fastener such as a countersunk rivet interconnecting the two scissors blades **80** and **82**. First and second scissors blades **80** and **82** are identical with each other, but are given different reference numbers here to facilitate understanding of their interaction with each other. Each of the blades **80** and **82** includes a respective base portion **86** extending from the scissors pivot joint **84** toward the respective handle **34** or **36** with which the particular blade is interconnected. A cutting portion **88** of each blade extends away from the scissors pivot joint **84** and culminates in a blade tip **90**. The base portion **86** of each of the scissors blades **80** and **82** includes an aperture **92** that fits snugly around a respective one of the scissors pivot pins **78** in handle pivots which define respective handle pivot axes **79** about which each base portion **86** rotates with respect to the respective handle **34** or **36**.

Each of a pair of identical rockers **94** and **96** includes an aperture **98** which also fits around a respective scissors pivot pin **78**, permitting each of the rockers **94**, **96** to pivot smoothly about the respective scissors pivot pin **78** which thus defines a respective rocker pivot axis coinciding with the handle pivot axis **79**. The rocker **94** is thus associated with and located alongside the first scissors blade **80**, and the rocker **96** is associated with and located alongside the second scissors blade **82**. The scissors pivot pin **78** is preferably of a length which when fully tightened leaves some axial clearance for the scissors blade base portion **86** and the respective rocker **94** or **96** so that they are generally free to move relative to each other, the pin **78**, and the respective handle **34** or **36**, as will be explained presently.

Each of the rockers **94** and **96** includes a projecting pin **100**, which may be made as a separate piece and fastened thereto but preferably is formed by swaging the rocker. The pin **100** projects toward and into a slot **102** in the base portion **86** of the adjacent scissors blade **80** or **82**, which receives the pin **100** of the associated rocker **94** or **96** and

permits the rocker to rotate through only a limited angle with respect to the associated scissors blade **80** or **82**, about the rocker pivot axis defined by a respective scissors pivot pin **78**. While the slot **102** is shown as a kidney-shaped slot extending entirely through the base portion **86** of each scissors blade **80** or **82**, it is conceivable that the slot **102** may be of another shape or may not extend the entire distance through the respective base portion **86**, so long as it receives the pin **100** and thus limits movement of the respective rocker when the rocker and base portion are located closely alongside each other.

Included within each of the handles **34** and **36** are a pair of springs, a scissors blade spring **104** and a rocker spring **106**. As may be seen in FIGS. **5** and **7**, these springs are generally similar in shape and are located side-by-side within each cavity **44** or **52**. An anchoring end **108** of the scissors blade spring **104** and an anchoring end **110** of the rocker spring **106** include apertures which fit snugly on the respective tool pivot shaft **74**. A hump **111** located in a middle portion of each rocker spring **106** protrudes into the cavity **44** or **52**. A similar hump **111** is preferably present in the corresponding location on each scissors blade spring **104**, but could optionally be omitted.

The springs **104** and **106** extend along the bottom **66** over a portion of the length of each handle **34**, **36** to the bottom **112** of a slot defined in the end of bottom **66** nearer to the scissors pivot pin **78** of each handle. The respective tips **114**, **116**, of the scissors blade spring **104** and rocker spring **106** extend along the slot in the bottom **66** and are thus free to move toward and away from the respective scissors pivot pins **78**, in contact with and following the shapes of the respective base portions **86** and rockers **94**, **96**, but the sides of the slot **112** keep the springs **104** and **106** from moving laterally and thus keep them aligned with the respective scissors blade **80** or **82** and rocker **94** or **96**.

The tips **116** of the rocker springs, are each tapered in width to be about 0.025 inch narrower than the anchoring ends **108** and **110**, to provide lateral clearance between the adjacent spring tips **114** and **116**, as shown in FIG. **5**. This ensures that the springs can flex and the spring tips **114** and **116** can move independently of each other without the need for a spacer plate between the springs **104** and **106**. The spring tips **116** are each also about 0.02 inch narrower than the thickness of each of the rockers **94**, **96** on which they act, to ensure that the spring tips **116** engage only the intended rocker **94** or **96**. The blade spring tips **114** may similarly be tapered in width, but it may be desirable not to taper the blade spring tips, in order to have the blade spring tips **114** as strong as practical where they contact the base portions **86** of the scissors blades. The anchoring ends **108** and **110**, on the other hand, are together about 0.010 inch thicker than the combined thicknesses of the scissors blades **80**, **82** and the rockers **94** and **96** so that the blades and rockers can be moved easily into the cavities **44** and **52** of the handles **34**, **36**.

With the folding tool **30** in the folded configuration shown in FIGS. **2–7**, a generally flat surface **118** of each base portion **86** rests against each scissors blade spring tip **114**, and a generally flat surface **120** on each rocker **94** or **96** rests against the rocker spring tip **116**, with the respective tips **114** and **116** pressing against the flat surfaces **118** and **120**.

The springs **104** thus urge the scissors blades **80**, **82** to rotate about the respective scissors pivot pins **78** toward the stowed position shown best in FIG. **7**, with the base portion **86** of each of the scissors blades **80**, **82** nested snugly between the respective scissors blade spring **104** and the oppositely located rocker spring **106**. As a result, the scissors blades are rotated with respect to each other about the scissors pivot joint **84** so that the blade tips **90** are located about 10° past each other, in a crossing configuration, when the scissors blades **80**, **82** are in their respective stowed positions within the cavities **44**, **52** defined by the handles **34**, **36**.

At the same time, the rocker springs **106** press against the flat surfaces **120** of the rockers **94**, **96** urging them to rotate in the same direction as the respective base portion **86** with which each rocker is linked by the respective combination of a pin **100** and slot **102**. The pin **100** is located so as to be in contact with the interior surface defining the slot **102** so that the force of the rocker spring **106** is carried through the in **100** and slot **102** and helps to urge the scissors lades to rotate into the respective cavity **44** or **52** defined within the handle **34** or **36** with which the respective scissors blade **80** or **82** is interconnected. Because the scissors blades **80**, **82** are interconnected through the scissors pivot joint **84**, all four springs, both of the scissors blade springs **104** and both of the rocker springs **106**, urge the scissors blades **80**, **82** into the crossing configuration shown in FIG. **7** and urge the handles **34**, **36** together to retain the tool **30** in its folded configuration.

When the tool **30** is in the folded configuration the ends of the handles **34** and **36** are held aligned with each other laterally by protruding ears **122** located on the anchoring ends **108** of the scissors blade springs **104**, and by cam lobes **124** included in each of the rockers **94**, **96**. The ears **122** overlap and are located alongside each other and between each other and the base of an adjacent folded tool blade, as shown in FIG. **4**, keeping the tool bit ends of the handle aligned with each other. The cam lobes **124** similarly extend alongside each other and between each other and one of the side walls **68** in the narrow scissors end portion **64** of the opposite handle **34** or **36**, as shown in FIG. **3**, keeping the scissors ends of the handles **34**, **36** aligned. The ears **122** may, as shown in FIG. **4**, be slightly narrower than the rest of the anchoring end **108** or **110** to avoid interference as they pass by each other as the tool **30** is being folded. It will be understood that the ears **122** might be provided on the rocker springs **106** instead of the scissors blade springs **104** with the same results.

Each scissors blade **80** and **82** has an outer margin **125** which rests closely along an inner surface of the tip **116** and a very small distance away from the hump **111** of the opposite rocker spring **106** inside the opposite cavity **44** or **52**. The tool **30** in its folded configuration thus is as compact as practical, yet each scissors blade incorporates all the material for which there is room within the cavity to ensure adequate strength.

For use, the scissors **32** are deployed from the folded configuration of the folding tool **30** by separating the handles **34**, **36**, rotating each of the scissors blades **80**, **82** about one of the scissors pivot pins **78** with respect to the handle **34** or **36** with which it is interconnected. As the scissors blades **80**, **82** are rotated with respect to the handles **34**, **36**, for example, by rotation of the second blade **82** with respect to the handle **36** to the position shown in FIG. **8**, both the scissors blade spring **104** and rocker spring **106** of the respective handle are forced to flex away from the scissors pivot pin **78** by respective cam surfaces **126** of the base portions **86** of the scissors blades, and similar cam surfaces **128** of the rockers **94**, **96**. The cams at first strongly resist movement of the scissors blades **80** and **82** away from their stowed positions within the cavities **44** and **52**, and because of the linking provided by the pin **100** within the slot **102**,

both the scissors blade base portions **86** and the rockers **94** and **96** resist such relative movement of the scissors blades **80** and **82** away from their stowed positions in the cavities **44** and **52**. Once the spring tips **114** and **116** are resting against the cam surfaces **126, 128**, however, only friction resists further movement of the handles through a small angle, after which the spring tips **114** of the scissors blade springs **104** encounter the flat detent surface **129** on the base portion **86** of each of the scissors blades **80** and **82**. Each flat detent surface **129** is oriented approximately perpendicular to the length of the respective scissors blade **80** or **82**, and acts together with the respective scissors blade spring tip **114** as a detent to hold the respective handle **34** or **36** stable with respect to the scissors blade **80** or **82**, in a position similar to that of the handle **36** as shown in FIG. **8**. This position improves the ease and safety of gaining access to the tool bits stowed in the particular handle, such as the screwdriver and cap lifter **46**, the flat Phillips screwdriver **48**, and the tweezers **50**, in the handle **36**. When both handles **34** and **36** are similarly positioned the respective detents hold the two handles in line with each other so that a scale **131** inscribed on the handles can be used for measurements up to the combined lengths of the two handles **34** and **36**.

Moving each handle **34** or **36** further in the same direction with respect to the attached scissors blade **80** or **82** brings the respective scissors blade spring tip **114** onto the flat surface **130** on each base portion **86**, and the force of each scissors blade spring **104** then urges the respective scissors blade to rotate toward the deployed position shown in FIGS. **1** and **9**.

When a scissors blade **80** or **82** is in the deployed position the respective spring tip **114** of the scissors blade spring **104** rests against a handle extension stop **132** which then prevents the handle from moving further with respect to the scissors blade base portion **86**. As a result, when both of the blades **80, 82** are deployed, with the handles **34, 36** fully extended as shown in FIG. **9**, the scissors blade springs **104** and rocker springs **106** face toward each other. Movement of the handles **34, 36** toward each other then results in movement of the cutting portions **88** of the scissors blades toward each other in a scissors blade closing direction.

Each of the rockers **94, 96** includes a finger-like outer end **134** which rests against a cam surface **136** of the base portion **86** of the opposite scissors blade. Thus the outer end **134** of the rocker **94** rests against the cam surface **136** of the base portion **86** of the scissors blade **82** as shown in FIGS. **1** and **9**. Since the cam lobe **124** of the rocker **94** rests against the rocker spring **106** associated with the handle **34**, movement of the handles **34, 36** toward one another is resisted by the force of the spring **106** as the cam face **136** moves into contact with the outer end **134** of the rocker **94** and moves it in a counterclockwise direction about the scissors pivot pin **78** of the handle **34**. As the handles **34, 36** are moved toward each other to move the cutting portions **88** toward each other in a cutting motion of the scissors blades **80, 82** about the scissors pivot joint **84**, the rocker springs **106** oppose further movement in such a scissors-closing direction. However, because of the size of the slot **102** or equivalent opening defined in the base portion **86** of the blade **80**, the rocker **94** is free to move counter-clockwise about the scissors pivot pin **78** with respect to the scissors blade **80**, except as such movement is opposed by the rocker spring **106** of the handle **34**.

As the outer end **134** moves along the cam surface **136** toward the scissors pivot joint **84**, the lever arm lengths about the scissors pivot pin **78** and the scissors pivot joint **84** change. The force required to continue to move the handles **34, 36** toward each other thus increases less than the force exerted by the spring **106** increases, and the force on the handles **34** required for closing the cutting portions **88** of the scissors blades does not increase unpleasantly during a complete cutting stroke of the scissors **2**.

Referring now to FIG. **10**, when the cutting portions **88** of the scissors blades have completed a cutting stroke the blade tips **90** are barely past one another. Rotation of the rockers **94, 96** has then flexed each rocker spring **106** so that its tip **116** is displaced toward the facing spring tip **114** of the scissors spring **104** of the opposite handle. Each spring tip **116** is thereby moved into contact with the spring tip **114** in the opposite one of the handles **34** and **36** preventing further movement of the handles **34, 36** toward each other, completing a cutting or blade-closing stroke of the scissors **32**.

When pressure on the handles **34, 36** is released, the potential energy stored in the rocker springs **106** moves the rockers **94, 96**. The outer ends **134** act upon the cam surfaces **136** of the opposite base portions **86**, so that the rocker springs **106** open the cutting portions **88** of the scissors blades in preparation for a subsequent cutting stroke.

The scissors blades are prevented from opening beyond a desired position where the edges of the cutting portions **88** are still registered with one another ready to cut material, by a scissors opening stop **138** included in the base portion **86** of each of the scissors blades. The scissors opening stop **138** encounters an outer face **140** of the rocker, as shown in FIG. **11**, rotating the rocker **94** clockwise and the rocker **96** counterclockwise, as shown, until the pin **100** engages the interior of the slot **102** into which it extends and thereby is prevented from rotating further with respect to the base portion **86** of the scissors blade interconnected with the one of the handles on which the particular rocker is located.

When it is desired to return the tool **30** to its folded configuration with the scissors blades **80, 82** in their stowed position within the cavities **44, 52**, it is necessary simply to move the handles **34, 36** away from each other beyond the position where the scissors blades are prevented from opening further. The scissors blade springs **104** and rocker springs **106** are thereby flexed as their tips **114, 116** again encounter the cam faces and flats **126, 128**. When the spring tips **114, 116** begin to ride off the cam surfaces **126, 128** they again act against the flat surfaces **118** of the base portions **86** and the flat surfaces **120** of the rockers **94, 96** to urge the handles **34, 36** to spring toward one another into the folded configuration as described previously.

As the handles **34, 36** are moved toward their respective folded positions, hump **111** of the respective rocker spring **106** approaches the outer margin **125** of each of the blades **80, 82**. If the tool bit ends of the handles move closer toward each other than the separation between the scissors ends of the two handles at that time the hump **111** causes the scissors blades **80** and **82** to rotate about the scissors pivot joint **84** toward the crossing configuration, thus bringing the scissors pivot pins **78** and the scissors ends of the handles closer together. As a result, the tool moves smoothly into the folded configuration regardless of where pressure is applied along the length of each handle **34** or **36**.

With the appropriate one of the handles **34** or **36** moved to a position such as that of the handle **36** as shown in FIG. **8**, a desired one of the additional tool blades can be rotated into an extended position such as the position of the flat Phillips screwdriver blade **48** as shown in FIG. **12**. The handles **34, 36** can then be returned to the closed configuration with respect to each other while the extended tool blade is held in place by the action of the leaf spring **76** against a base portion of the tool blade in the manner

well-known in folding knives. With the handles **34**, **36** held close together by the action of the scissors blade springs **104** and rocker springs **106**, and with the ears **122** of the scissors blade springs and the cam lobes **124** of the rockers **94**, **96** extending into spaces provided alongside each other in the opposite handles as explained previously, the handles **34**, **36** are held in place with respect to each other, allowing screwdriver blades to be used without the handles **34**, **36** being displaced laterally from each other by the twisting force used.

The above-described arrangement for holding a folding tool incorporating the scissors blades **80**, **82** in a folded configuration and for urging the blades **80**, **82** open when they are in their deployed position with respect to the handles may also be used for operation of tools such as pliers or special grasping tools, not shown, which include a pair of relatively movable interconnected members such as jaws or jawlike members which pivot with respect to each other about a jaw pivot joint corresponding to the scissors pivot joint **84**. Such jaws or jawlike members include acting portions corresponding to the cutting portions **88** of the scissors blades **80**, **82**, and an arrangement of springs, which may be referred to in such devices as jaw springs, corresponding to the scissors blade springs **104**, would act upon base portions of the jaws or jawlike members of such a tool. Similarly, such a tool would include rockers such as the rockers **94**, **96** linked with the base portion of such jawlike members and interacting with such jawlike members to limit their movement appropriately and to assist in keeping the folding tool including such jaws or jawlike members securely in its folded configuration.

In order to make the folding tool **30** as compact as possible yet have a Phillips screw driving capability, the flat Phillips screwdriver blade **48** is generally planar, rather than having a cruciform driving end. The blade **48** tapers similar to the flutes of a Phillips screwdriver from a maximum thickness at **49**, beyond the angled faces **51**, to a minimum thickness of 0.022 inch at the transverse end face **53**. The angled faces **51** form an included angle **55** of 53°, corresponding to the shape of a Phillips head screw socket, and the transverse end face **53** preferably has a width **57** of 0.074 inch, which is narrow enough to fit into the socket of most Phillips screws intended to accept a No. 1 Phillips screwdriver. However, because the flat Phillips screwdriver blade **48** lacks a pointed end, and is thus wider at its transverse end face **53** than a normal Phillips screwdriver, it fits drivingly in the socket of a Phillips screw intended to be driven by a No. 2 Phillips screwdriver. The flat Phillips screwdriver blade **48**, then, although generally planar, can be used to function in place of either a No. 1 or a No. 2 Phillips screwdriver.

An opening **144** is defined in one of the side walls **68** of the handle **36**, and the tweezers **50**, which include a base portion **146** and a pair of legs **148**, are stowed generally within the cavity **52**, alongside the flat Phillips screwdriver **48**. Each of the legs **148** has a length extending parallel with the handle **36** as shown in FIG. **6**, a thickness **150**, and a width **152**, indicated in FIG. **5**, so that as shown herein an outer side face **154** of each leg **148** is located generally flush with an outer face **156** of the side wall **68** defining the opening **144**. The provision of the opening **144** permits the width **152** of each tweezers leg **148** to be greater than would otherwise be possible given the overall size of the handle **36**, and it also permits each tweezers leg **148** to have an even greater width **152** where it is acceptable for the outer side faces **154** to protrude beyond the outer face **156**.

The tweezers **50** may be made by cutting a flat sheet of metal to include the base **146** and legs **148**, and then folding the legs **148** upward to bring the legs **148** perpendicular to the base **146** with the outer side faces **154** in a single plane. The legs **148** are thus thinner than they are wide and are oriented with their width generally perpendicular to the plane of the base portion **146**.

The lanyard ear **54** is mounted rotatably on the same tool pivot shaft **74** on which the base portion **146** of the tweezers **50** is located. The lanyard attachment ear **54** is located between the base portion **146** of the tweezers **50** and the nearer side wall **68**, acting there as a spacer to locate the base portion **146** of the tweezers axially along the tool pivot shaft **74** on which both are located for rotation. The lanyard attachment ear **54** is movable selectively in the direction of the arrow **60**, between the position shown in FIG. **2** and that shown in FIG. **13**, which requires prior removal of the split ring **56** from the hole **58**. In either of the positions described, the leaf spring **76** in its normal relaxed position extends along one of the two flat surfaces **158** and **160**. Movement of the lanyard attachment ear **54** between the two positions, however, results in a cam surface **162** between the two flat surfaces **158** and **160** being brought to bear against the leaf spring **76**, which opposes such movement. Thus, the lanyard attachment ear **54** is held stably in the position shown in FIG. **13**, resulting in the exterior surface configuration of the folding tool **30** being generally smooth and unlikely to cause excessive wear in a pocket of a person's clothing as a result of carrying the tool **30**.

Turning now to FIGS. **14–16**, a folding multipurpose tool **280**, shown in a folded configuration in FIG. **14**, includes a pair of handles, a first handle **282** and a second handle **284**, each having a scissors blade, or inner, end **286** and an opposite outer end **288**. The multipurpose tool **280** includes several separate tool blades or bits, including a knife blade **290** and a fingernail tool **292** located within the second handle **284**, and a pair of tweezers **294** and a small screwdriver **296** located within the first handle **282**, with a lanyard ear **54** alongside the tweezers **294**. The several separate tool blades or bits **290**, **292**, **294**, and **296** are individually available to be moved outward from their respective stowed positions while the two handles **282** and **284** remain alongside each other in the folded configuration of the multipurpose tool **280** as shown in FIGS. **14** and **15**. Referring to FIG. **16**, where the separate tool blades are shown in partially opened positions, each of the separate blades **290**, **292**, **294**, and **296** defines a respective pivot hole and is attached to the respective handle **282** or **284** by one of a pair of pivot shafts **298** each located at the outer end **288** of the respective one of the handles **282**, **284**. The pivot shafts **298** may be of the same construction as the tool pivot shafts **74** described above.

A pair of scissors **299** includes blades **300** and **302** and a pair of rockers **304** and **306** similar, respectively, to the scissors blades **80** and **82** and the rockers **94** and **96** of the folding scissors **32** described previously, and the scissors blades **300** and **302** are interconnected by a pivot joint **308** which corresponds with the joint **84** described previously. The scissors blades **300**, **302** and rockers **304**, **306** are pivotally carried on respective pivot shafts **298** located at the scissors blade or inner end **286** of each of handles **282**, **284**.

Associated with each scissors blade **300** or **302** is a respective scissors blade spring **310** which may be identical with the scissors blade springs **104** described previously. Alongside each scissors blade spring **310** is an identical rocker spring **312**. An anchoring end **314** of each scissors blade spring **310** and an anchoring end **316** of each rocker spring **312** include apertures which fit snugly on the pivot shaft **298** at the outer end **288** of the respective handle **282** or **284**.

A pair of tool bit springs **318**, each having an anchoring end **320** and an opposite outer end **321**, are also identical to the scissors blade springs **310**, and are located in the handles **282**, **284**, but extend in the opposite direction from the scissors blade springs **310** and rocker springs **312**. The anchoring ends **320** thus are fitted snugly on the pivot shafts **298** located at the scissors blade, or inner, ends **286** of the handles **282** and **284**. The spring **318** for each tool blade or bit thus also serves as a spacer for that tool blade or bit at the opposite end of the handle.

The handles **282** and **284** are similar but not identical with each other. The handle **282** consists basically of the two pivot shafts **298** located respectively at the inner and outer ends **286** and **288**, and a first handle side **322** and a second handle side **324** which are similar to each other, except for a nail cutout **333** and a cutout **326** defined in the first handle side **322**, to accommodate the tweezers **294** in its stowed position, and different radii of curvature of the corners. The second handle **284** differs in that a first handle side **328** and a second handle side **330** are both generally symmetrically opposite, or mirror images of, the second handle side **324** of the first handle **282** and are identical with each other except for the radii of curvature of the corners. Preferably, the shapes of the anchoring ends **314**, **316** and **320** of the springs are similar to the shape of each of the opposite ends of the handle sides **322**, **324**, **328** and **330**, as may be seen in FIGS. **16** and **17**, to present a fairly smooth configuration of the multipurpose tool **280** when it is in its fully folded configuration as shown in FIG. **14**.

Each of the handle sides **322**, **324**, **328**, and **330** includes a flange **332**, formed as an integral part of the respective handle side, extending longitudinally along the back margin of the handle side, directed perpendicularly away from it and thus directed toward the other one of the pair of handle sides of the respective handle **282** or **284** of which it is a part. The handle sides **322**, **324**, **328** and **330** thus have an L shape, including the flange **332** as the bottom leg of the L. The flanges **332** may include a small crescent-shaped cutout **333** to give better access to the tool bits. Each handle side is preferably made by cutting a piece of sheet metal to shape, and then forming a groove and bending the flange **332** in the appropriate direction to a position perpendicular to the plane of the respective handle side. Each of the handles **282** and **284** defines a respective cavity **334** between its first handle side **322** or **328** and its second handle side **324** or **330**, and each flange **332** has an inner surface **336** and an outer surface **338**.

Each of the scissors blade springs **310**, rocker springs **312**, and tool bit springs **318** includes a shoulder **340** defining an end of a surface **342** that extends toward the anchoring end **320** and faces toward the inner surface **336** of the adjacent flange **332**. A back surface **344** of the outer end portion of each of the scissors blade springs **310**, rocker springs **312**, and tool bit springs **318** extends away from the shoulder **340**, and is aligned with the outer surface **338** of the flange **332**. The outer end or tip of each of the scissors blade springs **310** rests against the base of the respective scissors blade and the tip of each rocker spring **312** rests on a surface of the respective rocker with a force generated by elastic bending of the respective spring **310** or **312**, and, to a lesser degree, by elastic bending of the anchoring end portion thereof, with the respective flange **332** supporting each of the springs along its surface **342**, and particularly the portion of the surface **342** adjacent the shoulder **340** of each of the springs, while the adjacent handle sides and adjacent tool bit spring anchoring ends **320** keep the scissors blade springs **310** and rocker springs **312** laterally aligned. The number of blades or bits a handle may contain is limited only by the width of the flange **332** (the length of the "L" leg) and the thickness of the tool bits and springs.

The respective flanges **332** of the first handle side **322** and first handle side **328** are adjacent to and lie against each other with their outer surfaces **338** in contact with each other at the inner or scissors blade end **286** of each of the handles when the tool **280** is folded, as shown in FIG. **14**. The flanges **332** of the second handle sides **324** and **330**, however, are located adjacent the outer ends **288** of the respective handles **282**, **284** and are located on the sides of the handles **282**, **284** which are remote from each other when the tool **280** is in the folded configuration as shown in FIGS. **14** and **15**. The flanges **332** of the second handle sides **324** and **330**, on the other hand, face toward each other when the handles **282**, **284** are extended to deploy the scissors **299**, as shown in FIG. **17**. This orientation of the first handle side **322** and first handle side **328** provides for the tool bit springs **318** to have their outer or free ends in contact with respective flat surfaces of the base of each of the tool bits or blades **290**, **292**, **294**, and **296** to retain each of them stably in either a closed configuration as shown in FIG. **14** or a fully open position (not shown), similar to the retention of each of the scissors blades as explained above with respect to the scissors **30**, and operation of the scissors **299** is substantially the same as operation of the scissors **32**.

The separate first handle sides **322** and **328** and second handle sides **324** and **330** of the handles **282**, **284** permit the handles **282**, **284** to be assembled by stacking the several tool bits, rockers, and springs, as well as the handle sides, on the respective pivot shafts **298**, as shown most clearly in the exploded portion of FIG. **17**, allowing each of the several tool bits and springs to be put into place individually on the respective pivot shafts **298**.

As shown in FIGS. **18**, **19** and **20**, a multipurpose tool **350** is assembled of parts similar to those included in the multipurpose tool **280**, and has a single handle **352** including a first handle side **322** identical with that of the first handle **282**, and a second handle side **330** identical with that of the second handle **284** of the multipurpose tool **280** described above. The first and second handle sides **322** and **330** are interconnected by a pair of pivot shafts **298**, and four tool bit springs **318** aligned with each other are located in a cavity defined between the handle sides **322**, **330** with their anchoring ends **320** all side-by-side at an outer end **354** of the. handle **352**. The bases of several tool blades or bits, the same knife blade **290**, fingernail tool **292**, tweezers **294**, and screwdriver **296** being shown here, are all mounted side-by-side between the first and second handle sides, at the inner end **356** of the handle **352**. The flanges **332** of the first and second handle sides **322** and **330** thus are both located adjacent the outer end **354** of the handle **352** and are directed toward each other on the same side, that is, the back side **358** of the handle **352**, and each of the tool bits or blades is available individually on the other, or front side **360** of the handle **352**.

It will be understood that different tool blades or bits could be included in the multipurpose tool **280** or the multipurpose tool **350**, instead of those shown, without departing from the present invention.

As shown in FIGS. **21** and **22**, a multipurpose tool **370** which is yet another embodiment of the invention has a handle **372** similar to the first handle **282** of the tool **280** described above and includes four tool bit springs **318** located in an arrangement similar to that of the tool bit springs **318**, the scissors blades spring **310** and the rocker

spring **312** within the first handle **282** of the tool **280**. Instead of the scissors blade and rocker of the multipurpose tool **280**, however, a knife **290** and a fingernail tool **292** are mounted on the pivot shaft **298** located at a first, or inner end **374**, while a pair of tweezers **294** and a small screwdriver **296** are mounted on the pivot shaft **298** located at the other or outer end **376** of the handle **372**. The use of the first handle side **322** and second handle side **324** as in the first handle **282** in this arrangement allows the tool **370** to have blades opening from each of the ends **374** and **376** of the tool handle **372**.

The use of a pair of handle sides which are identical or which are symmetrically opposite, or mirror images of each other with respect to the location of the flange **332**, allows selection of at least four different handle arrangements, as will be understood. In each such handle arrangement, furthermore, the handle construction. in accordance with the present invention is simpler than that of an ordinary jack-knife in which a central pin has traditionally been used to fasten individual blade springs in place, since each tool bit spring **318** is supported by a respective flange **332** near the shoulder **340** and along the surface **342**, thus providing for a smaller tool, since the individual springs **318** do not need to be deep enough to define a pin hole adjacent the location of the shoulder **340**.

A multipurpose tool **380** shown in FIG. **23** includes a pair of elongate handles **382**, **384** interconnected respectively with a pair of pliers jaws **386**, **388** interconnected with each other by a pivot joint **390**. It will be understood that scissors blades (not shown) might replace the pliers jaws **386**, **388**. A first end **392** of each of the handles **382**, **384** has attached thereto and movable about a respective pivot shaft **394**, several tool blades or bits such as a can opener **396**, a Phillips screwdriver **398**, and a small screwdriver **400** housed in the second handle **384**, while a knife blade **402**, a medium screwdriver **404**, shown fully extended, and a large screwdriver **406** are included in the first handle **382**. Each of the tool blades or bits has a base portion defining a pivot hole **407**.

Each of the handles **382**, **384** is movable with respect to the pliers jaws **386**, **388**, about a respective pivot shaft **394** located at a second end **408** of each of the handles **382**, **384**, so that with all of the tool blades and bits stowed within the handles **382**, **384** and with the handles rotated about the pliers jaws **386**, **388** as indicated by the arrows **409**, the multipurpose tool **380** assumes a compact form with a generally rectangular cross section, similar to the shape of the tool shown in U.S. Pat. No. 4,238,862, and can be carried safely in one's pocket.

The handles **382** and **384** are practically identical with each other, each having a first handle side **410** and a second handle side **412** both of sheet metal of suitable strength and thickness. Each handle side **410**, **412** includes a respective flange **414**, **416** as an integral part extending along the length of the handle side and directed perpendicular to it toward the opposite one of the handle sides, so that the two flanges **414**, **416** are aligned coplanar with each other, as may be seen best in FIG. **24**. Each of the handle sides **410**, **412** thus is L-shaped in cross section, as shown in FIG. **24**, so that the flanges **414** and **416** strengthen and stiffen the handle sides **410**, **412** along their length.

At the first end **392** of each handle, each of the handle sides **410**, **412** includes a leaf spring **418**, **420**, extending longitudinally of the handle from the portion of the flange **414**, **416** closest to the first end **392**, and defined by respective slits **417** and **419** cut in the material of which the respective handle side **410** or **412** is made. The leaf springs **418**, **420** extend in line with the flanges **414**, **416** when relaxed and are urged slightly outward by a peripheral surface of a base portion of one of the several blades or tool bits, such as the base **422** of the medium screwdriver **404** as shown in FIG. **27**, when such a tool blade is extended. As shown in FIG. **27**, an end surface **424** of each of the springs rests against an abutment surface such as the surface **426** defined on the base **422** of the medium screwdriver **404** when such a blade is in a fully open or extended position. Preferably there is a small space **427** between the flanges **414** and **416**, and thus between the springs **418** and **420**, to allow them to flex independently when in contact with a surface of the base of one of the knife or tool blades such as the knife blade **402** or the medium screwdriver **406**, although both of the springs **418** and **420** together rest against the base of the medium screwdriver **404**, as may be seen in FIG. **25**, where the screwdriver **404** is cut away for clarity. Pressure of the springs **418**, **420** against the surface of the base of one of the blades or tools helps to retain the blade or tool in either its folded position within the handle **382** or **384**, or in its extended position as exemplified by the position of the medium screwdriver **404** in FIGS. **26** and **27**.

At the second end **408** of the handles **382**, **384** an end surface **428** on each of the flanges **414**, **416** is in contact with a shoulder **430** defined on the base of each of the pliers jaws **386**, **388** so that movement of the handles **382**, **384** toward each other when the pliers are deployed as shown in FIG. **23** urges the tips of the jaws **386**, **388** toward each other. The flanges **414**, **416** thus extend over the full length of the handle sides **410**, **412**, to the ends **392** and **408**, except as limited by the required locations of the springs **418**, **420** and the end surfaces **428**.

The handle sides **410**, **412** of each of the handles **382**, **384** are held together by the pivot shafts **394** located at each end **392**, **408**. The pivot shafts **394** are preferably similar in type to the pivot shafts **74** described previously, and are tightened to provide the required amount of friction against the sides of the pliers jaws **386** and **388** and against the bases of the tool blades or bits located side-by-side at the first end **392** of each handle.

The use of the two L-shaped handle sides **410**, **412** in construction of the handles **382**, **384**, makes it easier to assemble the tool, since the pliers jaws and individual blades and tool bits can simply be placed one at a time upon the pivot shafts **394**. The proper amount of tension in each pivot shaft **394** may be applied easily without having to distort the shape of a formed channel of sheet metal, although the channel shape is still available for stowage of the several blades and tool bits, and the space **427** may be very small, resulting in exclusion of most, if not all, dirt from within the tool in its folded configuration. Since the pair of L-shaped handle sides **410**, **412** when assembled are not as rigid as a channel of the same material, however, it is preferable for each of the handle sides **410**, **412** to be made of material of a slightly greater strength or thickness than would be needed for a handle of channel form such as that described in the previously-mentioned U.S. Pat. No. 4,238,862.

This construction results in a multipurpose tool **380** which is of equal strength, but much simpler to assemble than previously known multipurpose tools of this type, and which provides the greater security of having more than one spring at the first end of each handle to help to retain individual ones of the several blades or tool bits, either in a folded, stowed, position or in an extended position. It will also be understood that the advantageous simplification of assembly would be available if the flanges **414**, **416** were of different widths or of mating interrupted shapes, rather than extend-

ing over the full length of the handles **382**, **384**, but such construction would result in reduced stiffness of the handles **382**, **384** and thus is not as desirable for use with the pliers jaws **386**, **388**.

The terms and expressions which have been employed in the foregoing specification are used therein as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding equivalents of the features shown and described or portions thereof, it being recognized that the scope of the invention is defined and limited only by the claims which follow.

What is claimed is:

1. A folding multipurpose tool, comprising:

(a) a handle having a pair of opposite first and second ends;

(b) said handle including first and second elongate handle sides, said first and second handle sides being aligned with and located opposite each other;

(c) a tool blade having a base defining a pivot hole extending therethrough, said base being located between said first and second handle sides at said first end of said handle;

(d) a pair of fasteners respectively located adjacent said first and second ends of said handle, interconnecting said first and second handle sides of said handle and holding them parallel with each other, a first one of said fasteners extending through said pivot hole in said tool blade and attaching said tool blade pivotably to said handle;

(e) a flange, extending longitudinally along a portion of said first handle side and directed toward said second handle side, said first handle side and said flange being an integral piece of sheet metal separate and independent from said second handle side; and

(f) a spring attached to and extending from said flange and extending generally longitudinally with respect to said handle, said spring having an outer end located so as to contact said base of said tool blade when said tool blade is in a predetermined position with respect to said first handle side.

2. The folding tool of claim **1** wherein said spring is a leaf spring extending from said flange proximate said first end of said handle.

3. The folding tool of claim **2** wherein said second handle side includes a second flange extending longitudinally along a portion thereof and directed toward said first handle side, said second handle side and said second flange being an integral piece of sheet metal separate and independent from said first handle side, said second handle side also including a second leaf spring attached to and extending from said second flange proximate said first end of said handle and extending generally longitudinally with respect to said handle.

4. The folding tool of claim **3**, wherein a respective one of said flanges extends along each of said handle sides to respective locations proximate each of said opposite ends of said handle.

5. The folding tool of claim **3** also including a second tool blade having a base defining a pivot hole extending therethrough, said base being located between said first and second handle sides at said first end of said handle and said second leaf spring having an outer end located so as to contact said base of said second tool blade when said second tool blade is in a predetermined position with respect to said second handle side.

6. The folding tool of claim **1** also including a second said handle, each of said handles including a respective one of a pair of tool blades located between said first and second handle sides thereof and attached pivotably thereto by a second one of said pair of fasteners thereof at said second end thereof, said pair of tool blades being interconnected with each other by a pivot joint, and said first and second handle sides of each of said handles being spaced apart from each other and defining a respective cavity therebetween, a respective portion of each of said interconnected pair of tool blades being received in each said cavity when said tool is in a folded configuration.

7. The folding tool of claim **6** wherein said interconnected pair of tool blades are jaws of a pair of pliers.

8. The folding tool of claim **3**, wherein said first and second flanges are aligned opposite each other and directed toward each other from the respective ones of said handle sides.

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